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A SURVEY OF ECONOMIC AND SOCIAL CONDITIONS OF FARMERS IN SULU[1]

FRANCISCO M. SACAY, JAINARI S. KIBTIANI and MAJINDI K. ANUDDIN
Of the Department of Agricultural Education

Surveys on the economic and social conditions of farmers have been undertaken in several regions of the Philippines for the purpose of securing data and information on which rural improvement programs of rural schools, agricultural schools, and the agricultural extension service may be based. Most of these surveys, however, were conducted in districts occupied by Christian Filipino farmers, particularly in Luzon. It is, therefore, important that a survey of this nature be conducted in the Moroland.

Of literature pertaining to the conditions in the Moroland, particularly in the province of Sulu, the report of Orosa (1931) has a close bearing on the present work. He reported that the people in Sulu were largely engaged in agriculture, stock raising, and fishing. Other occupations were pearl diving, weaving, and making of vintas. The principal crops grown by the farmers were cassava, coconut, rice, corn, sugar cane, and fruits. The common recreational activities were dancing, Moro style; playing xylophones and gongs; and bullfighting. He further reported that the people, especially those residing in rural districts, were not interested in sending their children to school.

The investigation reported in this paper was made for the purpose of studying the following: (1) the economic conditions of farmers, such as type of farming, size of farm, crops grown, livestock raised, farm income, and family income; and (2) their social conditions, such as size of household, nature of dwellings, household facilities and conveniences, educational attainment, recreational activities, and membership in organizations.

The study was conducted from 1949 to 1950. The major part of the field work was performed from April to June, 1949, among 125 farmers on the island of Lapak and 125 farmers on the island of Siasi. These two islands are included in the municipal district of Siasi, province of Sulu. All these farmers were owner-operators. The data concerning the farm business were for the crop year 1948-49. The survey method of investigation was used.

The farmers in the island of Siasi who were included in the survey were residing in the barrios of Jambangan, Musu, Latung, Manta, and Tarra, and in the sitios of Siondo, Congtad, Bud, Tulling, Tausan, Siok, Bilao, Buan, Lumagunglung, Sioeng, Pislong, Sablay, and Nipa-nipa. In the island of Lapak, farmers surveyed were residing in the sitios of Hambilan, Malanta, Pandami, Sibaud, Sigangang, Suba-Suba, Bakal, Bud Lapak, Baligtang, Neog-Neog, and Ratag.

The island of Siasi is in the southeastern part of the Sulu Archipelago, midway between the islands of Jolo and Tawi-Tawi, bordering on the Cele-

[1] Experiment Station contribution No. 1554.

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bes Sea. Lapak island is also in the southeastern part of the Sulu Archipelago, west of Siasi.

In Siasi town proper, there is an elementary school, and a private high school which offers the first and second year. This high school is a branch of the Notre Dame College in Jolo, Sulu. Elementary schools are found in the barrios of Jambangan, Musu, Latung, Manta, and Tarra. Grade schools are located in the sitios of Congtad, Bud, Siondo, Tulling, and Sioeng. In Lapak, there is an agricultural high school. There are also elementary schools in the sitios of Sibaud and Pandami. Grade schools have been established in the sitios of Hambilan, Sigangang, Suba-Suba, and Ratag.

FINDINGS AND DISCUSSION

Age and birthplace of farm operators

The age of farm operators ranged from 20 to 69 years, or an average of 41.6. More than one half of the farm operators were 40 years old or over. Farmers whose age ranged from 20 to 29 consisted of 11.2 per cent. Only 3.6 per cent were 60 years old or over.

The majority of the farmers, or 76 per cent, were born in the barrios where they were residing. Another 20 per cent were born in other barrios of the municipality. Only 3.2 per cent were born in other municipalities of Sulu, and 0.8 per cent in other provinces.

At the time of the survey, these farm operators had resided in the barrio where they were farming for an average of 40.1 years and in the municipality for an average of 41.5 years. The small difference was due to the fact that farmers seldom moved away from the barrios where they were born. Only 11.2 per cent had been in their barrios for less than 25 years. Many of these were young people who had just started farming.

Length of farming experience

The operators had been engaged in farming from 1 to 60 years, or an average of 27.6 years. However, only 8.4 per cent had been farming for over 40 years. On the other hand, only 6.4 per cent had 10 years or less of farming experience.

Size and utilization of farm area

The farms ranged in area from 1 to 25 hectares, or an average of 6.02. About 90 per cent of the operators had farms of 10 hectares or less; about 31.2 per cent had less than 4 hectares. On big farms, the operators usually had helpers to furnish labor on the farm. These helpers were given a share of the products in proportion to their accomplishment.

The farm area was utilized as follows: for field crops, 4.67 hectares, or 77.6 per cent; for farmstead, garden, and orchard, 0.94 hectare, or 15.6 per cent; and for pasture and woods, 0.41 hectare, or 6.8 per cent.

Capital investment

The average capital investment in a farm was ₱1,708.80. This investment was apportioned as follows: land, 50.3 per cent; buildings, 17.6 per cent; tools, 2.2 per cent; work animals, 16.6 per cent; other livestock, 12.9 per cent; and seeds and supplies, 0.4 per cent.

Crops grown and livestock raised

The principal crops grown were coconut, cassava, rice, corn, sugar cane, and fruits. The minor crops were peanut, sweet potato, gabi, tobacco, and vegetables (table 1). Coconut was the most important crop and the main source of cash income. It was grown by all the farmers on an area of 580 hectares, or an average of 2.32 hectares to a farm. Cassava, being the common food crop, was also grown by the farmers. One common practice was to grow cassava, rice, and corn at the same time on the same lot. Cassava was also interplanted with rice, corn or peanut.

Lanzones and bananas were the common fruit crops grown. They were important sources of cash income. The vegetables commonly raised were eggplant and tomato.

Livestock raised

Carabaos and cattle were the work animals found on the farm. There were, on the average, 1.5 carabaos and 0.2 cattle per farm. On some farms that were devoted primarily to coconut production, work animals were not kept. Of the productive livestock, cattle was the most common among large animals, averaging 1.8 head to a farm. There were also horses, goats, chickens, ducks, and geese. The average number of chickens to a farm was 27.5 birds, of which 8 were laying hens.

Farm receipts and expenses

The farm receipts averaged ₱2,270.73. Of this amount, 87.5 per cent were from field crops; 9.4 per cent from vegetables and fruits; 1.1 per cent from livestock and livestock products; and 2 per cent from increase in capital. From field crops were obtained ₱1,986.89. About 57.8 per cent of the farm receipts came from coconuts; 11.6 per cent, from cassava; 6.2 per cent, from sugar cane; and 4.2 per cent, from rice (table 2). A big portion of the receipts came from coconuts. The price of a picul of copra during the 1948-49 crop year ranged from ₱45 to ₱50. The farm expenses averaged ₱1,029.71 to a farm. The important items of expense were the harvester's share, which amounted to 42 per cent; unpaid family labor, 33.1 per cent; and cash expenses, 18.9 per cent.

Labor income and labor earnings

The labor income per farm was ₱1,140.61. This amount represented what the farm operator received for his labor in addition to farm privileges, such as use of dwelling and consumption of farm products. The farm privileges amounted to ₱609.72, of which 78.7 per cent comprised field crops; 10.3 per cent, fruits and vegetables; 9.6 per cent, rental value of dwelling; and 1.4 per cent, livestock and livestock products. The operator's labor earnings, which included farm privileges, amounted to ₱1,750.33. This is much higher than the ₱155.01 reported by Sacay and Naanep (1940) for rice farmers in Ilocos Norte. Some of the factors that contributed to the larger labor earnings in Sulu are the following: size of farm, crops grown, and the postwar price level.

Family income and amount available for family living

The average family income was ₱2,145.95. This amount included the income of the operator from farming, his income from work outside the

farm, income of family members for working on the farm and from jobs off the farm. The operator contributed 84.1 per cent of the family income. If the interest earned by the operator's capital is added to the family income, the amount available for family living is obtained. This averaged ₱2,246.36, or ₱371.42 per member of the household.

Relation of certain factors to labor earnings

There was a tendency for labor earnings to increase with increase in the capital investment. The labor earnings also tended to increase as the crop area and the area planted to coconuts increased. No close relationship existed between coconut index and labor earnings. This was probably due to the fact that on smaller coconut holdings, the operators were able to give closer attention to their farms, resulting in a higher production per hectare.

Type and composition of households

Of the 250 households, the most common was the husband-wife-three children type, comprising 21.2 per cent. Households with 4 or 5 children numbered 79, or 31.6 per cent. The number of children ranged from 1 to 8. Only 3.2 per cent of the households surveyed did not have children.

The number of individuals in the household ranged from 2 to 12. The most common household, representing 20.8 per cent, had 5 persons. The average household had 6.04 individuals. This was distributed as follows: parents, 1.99; children, 3.96; relatives, 0.09.

Type and size of dwellings

All the dwellings studied had nipa roof and either bamboo or wooden floor and wall. The number of dwellings with wooden wall and wooden floor was 54, or 21.6 per cent. The most common type of dwelling had bamboo wall and bamboo floor, numbering 74, or 29.6 per cent. Another 18.8 per cent had nipa wall and bamboo floor (table 3). None of the dwellings had galvanized iron roof.

The average floor area of a dwelling was 50.7 square meters, or 8.35 square meters per person. The value of the dwellings ranged from less than ₱50 to over ₱2,000, or an average of ₱282.85.

Home facilities and conveniences

The common household equipment and conveniences were wooden benches, wooden beds, wooden chairs, bamboo chairs, bamboo beds, and iron chairs. About 84.8 per cent had wells on the farmsteads, but these wells were not provided with pumps. There were no kerosene stove, icebox, electric light, running water, radio, nor piano. About 23.6 per cent had xylophone.

Very little attention was given to homeground beautification. Only 3.2 per cent had hedges around the houses, and 4.8 per cent had hedges on front boundaries of the yards. About 5.2 per cent had potted plants in the house.

School attendance and educational attainment

Of the children 7 to 14 years old still living with their parents, only 70.1 per cent of the boys and 34 per cent of the girls had attended school.

Of those 15 to 24 years old, 57.4 per cent of the boys and 33.3 per cent of the girls had been to school. Of the children 7 years old and over who were living with their parents, only 49.2 per cent went to school. The average grade completed by sons and daughters 15 to 24 years old was 2.8.

Reading matter in farm homes

The most common reading matter found in farm homes was the Koran. About 72.8 per cent of the homes had this book. *Philippines Free Press* was found in 7.2 per cent of the homes. Some homes had *Philippine Journal of Education* and *Philippine Child Life*. The Koran excluded, only 16.4 per cent of the homes had reading matter.

Recreational activities

Among the adults, cockfighting, bullfighting, Moro dancing, chatting with friends, fishing, and playing the xylophone were the common recreational activities. Reading the Koran and singing Mohammedan hymnals were common leisure-time activities of women. Among children 10 years or over, the most common recreational activities were hunting, swimming, Moro dancing, singing, ball game, and reading. Reading and singing were popular among the daughters.

Membership in organizations

Of the adults, only 12 belonged to a parent-teacher association. Among the sons 10 years or over, 24 belonged to a student-body organization and 11 to the Boy Scouts of the Philippines.

SUMMARY

The important findings of a survey of the economic and social conditions of farmers in Siasi, Sulu, may be summarized as follows:

1. The average age of farm operators was 41.6 years. About 76 per cent were born in the barrios where they were residing, and 20 per cent in other barrios of the municipal district of Siasi.

2. The farm operators had been engaged in farming for an average of 27.6 years.

3. The average area of farm was 6.02 hectares, utilized as follows: 77.6 per cent for crops; 15.6 per cent for farmstead, garden, and orchard; and 6.8 per cent for woods and pasture. The capital invested per farm was ₱1,708.80, of which 50.3 per cent was in land, 17.6 per cent in buildings, 16.6 per cent in work animals, and 2.2 per cent in tools.

4. The important crops grown were coconut, cassava, and fruits. The minor crops consisted of sweet potato, gabi, peanut, sugar cane, and vegetables.

5. Each farm had on the average 1.5 carabaos and 0.2 cattle as work animals. The productive livestock raised were cattle, horses, and poultry.

6. The average farm receipts was ₱2,270.73, of which 87.5 per cent was obtained from the sale of farm crops. The farm expenses averaged ₱1,029.71 to a farm; labor income, ₱1,140.61; farm privileges, ₱609.72; labor earnings, ₱1,750.33; family income, ₱2,145.94. The amount available for family living was ₱2,246.36, or ₱371.42 for each member of the household.

7. The size of farm, crop area, and area planted to coconuts directly influenced labor earnings.

8. The average household contained 6.04 persons.

9. All the dwellings had nipa roof. Bamboo, nipa, and wood were common materials for flooring and walling. Home facilities and conveniences were limited. Very little attention was given to homeground beautification.

10. Of the children 7 years or over who were living with their parents, only 49.2 per cent had been to school.

11. There was a variety of recreational activities. Reading was one of the leisure-time activities, but this was limited to the Koran. Excluding the Koran, only about 16.4 per cent had reading matter in farm homes.

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TABLE 1

Crops and livestock raised

CROPS OR LIVESTOCK	NO. OF FARMS RAISING	RATIO OF FARMS RAISING TO TOTAL FARMS	TOTAL AREA, NUMBER OF PLANTS OR ANIMALS	AVERAGE PER FARM RAISING	AVERAGE FOR ALL FARMS
Field crops:		*per cent*	*hectares*	*hectares*	*hectares*
Coconut	250	100.0	580.0	2.32	2.32
Cassava-rice-corn[a]	123	49.2	268.3	2.18	1.07
Cassava-rice	56	22.4	72.8	1.3	.29
Cassava-corn	6	2.4	10.0	1.67	.04
Cassava-peanut	21	8.4	22.0	1.05	.09
Cassava	91	36.4	106.0	1.16	.42
Rice	13	5.2	26.5	2.04	.11
Sweet potato	18	7.2	4.7	.26	.02
Peanut	47	18.8	79.0	1.68	.32
Gabi	6	2.4	1.5	.25	.006
Sugar cane	8	3.2	5.2	.65	.02
Tobacco	1	.4	0.5	0.5	.002
Fruits:			*plants*	*plants*	*plants*
Banana	205	82.0	19,876	97.0	79.5
Papaya	28	11.2	672	24.0	2.7
Mangoes	107	42.8	1,212	11.3	4.8
Lanzones	161	64.4	10,577	65.7	42.3
Durian	48	19.2	390	8.1	1.6
Oranges	89	35.6	1,631	18.3	6.5
Other fruits	192	76.8	6,160	32.1	24.6
Vegetables:					
Eggplant	42	16.8	6,135	146.1	24.5
Tomato	36	14.4	5,435	151.0	21.7
Other vegetables	8	3.2	112	14.0	.4
Work animals:			*animals*	*animals*	*animals*
Carabaos	202	80.8	372	1.8	1.5
Cattle	40	16.0	40	1.0	.2
Productive livestock:					
Cattle	160	64.0	444	2.8	1.8
Horses	77	30.8	132	1.7	.5
Goats	13	5.2	104	8.0	.4
Chickens	185	74.0	6,869	37.1	27.5
Ducks	12	4.8	93	7.8	.4
Geese	5	2.0	16	3.2	.1

[a]Crops were interplanted.

TABLE 2

Summary of farm receipts, expenses, and income

	NUMBER OR AMOUNT	PERCENTAGE
Capital investment per farm, pesos	1,708.80	
Average size of farm, hectares	6.02	
Utilization of farm area, hectares:		
Farm crops	4.67	77.6
Farmstead, garden, and orchard	.94	15.6
Pasture and woods	.41	6.8
Farm receipts per farm, pesos	2,270.73	
Coconut	1,312.30	57.8
Cassava	262.60	11.6
Sugar cane	141.00	6.2
Rice	95.94	4.2
Peanut	65.08	2.9
Corn	54.79	2.4
Other field crops	55.18	2.4
Fruits and vegetables	214.00	9.4
Livestock and livestock products	25.66	1.1
Increase of capital	44.18	2.0
Farm expenses per farm, pesos	1,029.71	
Cash expenses	194.13	18.9
Harvesters' share	432.86	42.0
Unpaid family labor	341.01	33.1
Decrease of capital	61.71	6.0
Net farm income, pesos	1,241.02	
Interest on average investment, pesos	100.41	
Labor income	1,140.61	
Farm privileges, pesos	609.72	
Farm crops	479.73	78.7
Fruits and vegetables	62.86	10.3
Livestock and livestock products	8.39	1.4
Rental value of dwelling	58.74	9.6
Operator's labor earnings	1,750.33	
Family income in pesos	2,145.95	
Operator's labor earnings	1,750.33	81.6
Operator's income from job off farm	54.12	2.5
Income of other members of the family from farm (value of labor)	325.50	15.2
Income of other members from job off farm	16.00	0.7
Interest earned by operator's capital	100.41	
Amount available for family living	2,246.36	
Amount available for each member of the household	371.42	

TABLE 3

Social conditions

	NUMBER OR AMOUNT	PERCENTAGE
Average age of farm operators	41.6	
Birthplace of farm operators:		
In the barrio where residing	190	76.0
In the municipal district	240	96.0
In the province of Sulu	248	99.2
Years engaged in farming	27.6	
Number of individuals in household	6.04	
Classification of members in the household:		
Parents	1.99	33.0
Children	3.96	65.5
Relatives, others	.09	1.5
Dwellings with wooden wall, wooden floor	54	21.6
Dwellings with wooden wall, bamboo floor	25	10.0
Dwellings with bamboo wall, bamboo floor	74	29.6
Dwellings with nipa wall, bamboo floor	47	18.8
Floor area per dwelling, square meters	50.7	
Number of rooms per dwelling	1.8	
Number of persons to a room	3.5	
Number of dwellings with home conveniences:		
Sewing machine	52	20.8
Iron, wooden or bamboo beds	213	85.2
Electric light, kerosene stove, icebox, running water or radio	0	0
Well in farmstead	212	84.8
Phonograph	1	.4
Xylophone	59	23.6
Grade completed by children 15-24 years old:		
Male	3.2	
Female	2.3	
Number of homes with reading matter:		
Koran	182	72.8
Philippines Free Press	18	7.2
With reading matter other than the Koran	41	16.4

EFFECTS OF INBREEDING LAGKIT CORN[1]

José M. Capinpin and Roberto F. Cruz
Of the Department of Agricultural Botany

In nature Lagkit corn breaks into different types even when grown in an isolated place. Since trueness to type and constancy of performance are possible only in pure lines produced by successive inbreeding, this study was conducted in the plots of the Department of Agricultural Botany, College of Agriculture, at Los Baños from May, 1947, to March, 1948, to record the immediate effects of inbreeding in the first generation.

Shull (1908) was the first to undertake experimentally the inbreeding of a fairly homogenous variety of corn. He observed various biotypes which separated into component elements as a result of artificial "selfing." In 1909, he concluded that in any ordinary field of corn of one variety, the individuals are really of a very complex composition, and deterioration is due not to inbreeding but to the reappearance of some strains.

In the Philippines Elayda[2] found that the first generation of inbred Native Yellow Flint corn yielded twice that of the second generation.

Nisperos[3] showed by inbreeding Native Yellow Flint corn that the decrease in size and vigor was greater in the first generation than in the second generation.

Salvado[4] reported that the inbred lines of Native Yellow Flint corn greatly decreased in vigor, and the number of rows of kernels had a tendency to decrease as breeding proceeded.

Guevarra[5] found that the average stand of plants in each row of F_1 and F_2 inbred plants was lower than that in the control or open-pollinated crop.

MATERIALS AND PROCEDURE

The Lagkit corn used

The strain used for this experiment is called Lagkitan. It is grown both in upland and lowland areas in the small town of Teresa, Rizal. This Lagkit variety, as noted by Capinpin (1937), may be distinguished from

[1] Experiment Station Contribution No. 1555. Based on the thesis presented for graduation by the junior author with the degree of Bachelor of Science in Agriculture from the College of Agriculture, October, 1948, No. 1592. Prepared in the Department of Agricultural Botany under the direction of the senior author.

[2] Elayda, A. Preliminary experiments in the production of pure lines in corn. (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture. 1920. Unpublished).

[3] Nisperos, P. M. Inbreeding the Native Yellow Flint corn. (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture. 1929. Unpublished).

[4] Salvado, S. S. Inbreeding the Native Yellow Flint corn. (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture. 1930. Unpublished).

[5] Guevarra, M. R. A study of the effects of inbreeding on Cuban corn. (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture. 1943. Unpublished).

other white varieties of corn by the characteristic color of its kernel which is generally opaque or pearly white. The ears of this variety are uniform in size and shape.

The culture

From May 8 to May 17, 1947, the experimental lot, 10 by 25 meters, was plowed three times and harrowed after each plowing, and furrowed a meter apart lengthwise, with 10 furrows in the lot.

On May 17, 1947, three to five seeds were planted in each of the hills 70 to 80 centimeters apart in the furrows. Stakes were driven vertically into the ground at both ends of each furrow, and a label bearing pertinent data was attached to each stake.

Two weeks after planting, the growing corn plants, 20 to 30 centimeters tall, were thinned to three plants to a hill. A native plow was used in the single cultivation of the field during the entire growing period.

The Lagkit variety produced tassels 47 days after planting. Silking, on the average, occurred from three to seven days after tasseling.

The tassels and ear shoots of 10 plants in each furrow were bagged for the artificial "selfing," and the remaining plants, which were open-pollinated, served as the control. The long husks of a number of ear shoots were cut back slightly before bagging in order to encourage uniform and earlier emergence of silk. All bagging was done in the afternoon when the staminate inflorescence remained indehiscent.

Technique of inbreeding

The pollen of the tassels was transferred to the silk of the same plant to effect inbreeding. Pollen application was started as soon as the silk appeared, for the delay in bagging might cause overmaturity of the pollen or the silk, which would interfere with effective fertilization. Pollination was done in the morning when the stigmas were at the receptive stage. Each bagged tassel was bent over with the left hand in such a way that when the bag was tapped lightly with the right hand, the pollen grains were collected at the bottom of the bag. Then the paper clip was removed and the bag pulled off the tassel. The bag was folded in the middle to prevent contamination of the contents from stray pollen. Then the bag covering each ear shoot was removed and the bag containing the pollen inverted over the ear shoot and tapped lightly to shower the silk with pollen. After pollination, the ear shoot was covered again with the same paper bag.

Harvesting

The ears were harvested when the corn husks and grains were dry. The stalk was cut, leaving a portion still attached to the ear to provide a hook for hanging purposes. The harvested ears were hung on a hog-wire fence to allow them to dry further.

Planting of F_1 inbred seeds and their parents

The field covered 1500 square meters (25 by 60 meters). This cultural planting permitted observation and selection work between and within the rows of F_1 inbred strains. Planting of the F_1 inbred seeds and of the parents was done on October 24, 1947. For every five consecutive rows planted to inbred strains, a row was planted to the parent variety control.

Observation for chlorophyll-deficient plants and complete albinism and striping in each row, were determined by counts based on 100 plants.

The plants which did not attain the normal height at maturity, "dwarfs" lower than 115.81 centimeters, the average height of the control, or below 93.33 centimeters, the average height of the inbreds, were noted in each row.

The number of barren plants was also determined for all cases.

The arrangement of the rows of kernels on the cob was observed on dried and husked ears. Good marketable ears normally have symmetrical straight rows of kernels. This normal arrangement served as another basis for comparison between the control and the F_1 inbred individuals.

The percentages of chlorophyll-deficient, barren, dwarf plants, and ears with uneven rows of kernels were obtained by counting 100 plants picked at random in each row.

Measurements in centimeters of the height of 25 plants picked at random in all rows of the inbred plants and of the control were made. When the flowers were exposed fully and uniformly in all the sixty rows, the height of each plant was measured from the ground to the point of union of the blade with the sheath of the flag leaf.

The length and diameter of ears of the inbreds and of the parents were measured in centimeters with a wooden caliper. The diameter was taken one-third from the butt to the filled end of the ear.

Twenty-five ears picked at random from each row of the inbreds and the parents were husked, dried thoroughly in the sun, and weighed singly. The ears were shelled separately by hand and the grains from each ear were weighed.

RESULTS AND DISCUSSION

Chlorophyll deficiency. The F_1 inbreds had relatively more chlorophyll-deficient individuals than the parent plants (table 1a). The percentage of chlorotic plants produced by the parent averaged only 3.6; that of the F_1 inbreds ranged from 5.0 to 5.5. A similar experiment was conducted by Guevarra[6] on Cuban Flint corn inbreds in which the average percentage of chlorotic plants produced by the F_1 inbreds was 9.5, while the control or the open-pollinated parent plants produced 5.6 per cent chlorotic plants. This indicated clearly that one effect of inbreeding was the production of a greater number of chlorophyll-deficient plants in the first generation. The difference in variability regarding this character between the inbreds and the open-pollinated plants was highly significant.

Sterility or barrenness. Both the parents and the inbreds produced individuals which were decidedly sterile, that is, they did not develop ears although the plants reached maturity. To render the difference on a comparable basis, the percentage rather than the actual population was taken into consideration. Table 1b shows that there are more barren plants resulting from inbreeding than from open pollination. The F_1 inbreds produced 11.9 per cent barren plants and the control produced 6.8 per cent. Guevarra[7] reported 12.5 per cent sterile plants produced by the F_1 inbreeds and 5.6 per cent, by the control.

[6] *Ibid.*

[7] *Ibid.*

The difference in the sterile or barren plants produced by the F_1 inbreds and the open-pollinated parents was highly significant.

Dwarfness. A very marked influence of the retrogressing effect of inbreeding was shown in the dwarfing of a large number of individuals grown from first-filial-generation inbred seeds. As may be seen from table 1c, there are more short plants among the inbreds than among the open-pollinated plants. More than half as many dwarf plants appeared in the former than in the latter, with averages of 21.8 per cent and 10.4 per cent, respectively. Guevarra[8] found a similar result. He reported that the F_1 inbreds gave an average of 27.2 per cent dwarf plants and the control, 10.9 per cent. The difference in dwarfness between the F_1 inbreds and the control was highly significant (table 1c).

Arrangement of rows of kernels. The F_1 inbreds had a higher percentage of ears with zigzagging rows of kernels than the parents. The less occurrence of this undesirable character in the parents than in the F_1 inbreds favors the former. The predominance of the zigzagging rows of kernels in the inbreds is indicated by the data given in table 1d, 41.6 per cent for the inbreds and only 33.8 per cent for the control.

Height of plants. The data shown in table 2a indicates clearly that self-fertilization of Lagkit corn greatly decreased the height of the plants. The average height of the F_1 inbreds was 93.33 centimeters and that of the open-pollinated plants, 115.81 centimeters. There was a 24.1 per cent average decrease in height of the F_1 inbreds. The difference in the height of plants between the parents and the F_1 inbreds was highly significant.

Length of ears. Table 2b shows that the F_1 inbred plants produced ears shorter than those produced by the open-pollinated parent plants. The F_1 inbred plants had an average length of 7.64 centimeters, while the open-pollinated plants averaged 9.09 centimeters. The average decrease in length of ears of the F_1 inbreds was 15.9 per cent. The difference in the mean length of ears between the F_1 inbreds and the parents was significant.

Diameter of ears. Another retrogressive effect of inbreeding was manifested in the diameter of the ears of corn. Table 2c shows that the F_1 inbred plants produced ears of corn with a mean diameter significantly smaller than that of the parent plants. The average decrease in the diameter of the ears of the F_1 inbred plants was 7.4 per cent. The difference in the mean diameters of ears between the F_1 inbreds and the parents was significant.

Weight of unshelled ears. Table 2d shows that the mean weights of unshelled ears of corn produced by the F_1 inbred plants were lower than those of the parents. The average weight of unshelled ears harvested from F_1 inbreds was 18.80 grams and that of the parent, 27.98 grams. The decrease of 34.5 per cent represents a highly significant difference.

Weight of grains. The data in table 2c shows that the first-generation inbreds produced plants which gave a mean weight of grains from shelled ears lower than the open-pollinated plants. This indicates that naturally cross-fertilized Lagkit corn tends to decrease the weight of shelled grains when subjected to inbreeding. The shelled grains obtained from the F_1 inbreds had an average weight of 25.54 grams; those from the parents, 37.24 grams. The difference represents a 31.4 per cent decrease on the part of F_1 inbreds. This difference was highly significant.

[8] *Ibid.*

The theoretical considerations of inbreeding. Inbreeding has several effects, notably on naturally cross-pollinated plants. Shull (1909) found that the progeny of every self-fertilized maize plant was inferior in size, vigor, and productiveness to the progeny of a normal cross-bred plant derived from the same source. He further noted that the decrease in size and vigor following self-fertilization becomes less and less in the succeeding generation. He pointed out that one might consider a corn field to be a collection of complex hybrids whose elementary components may be separated by self-fertilization through the operation of the fundamental Mendelian laws of segregation and recombination.

East and Jones (1919) observed that inbreeding in maize reduces the size of plants and yield of grains. Furthermore, the several inbred lines originating from the same variety become more or less differentiated in morphological characters. Any commercial variety of maize is heterozygous for a large number of hereditary factors; the heterozygosis is kept up by continual crossing and recrossing. This naturally happens in open pollination. When such variety is inbred, there is systematic isolation of homozygous genotypes. If self-fertilization is practiced, stabilization through complete homozygosity is attained after a relatively small number of generations. During the process before stabilization is reached, there is a reduction in size, vigor, and productiveness.

East and Jones (1919) further noted that many of the characters which become homozygous will be recessives, and the combination of recessives is seldom seen under ordinary circumstances because they are hidden by their dominant alleles. These recessives are the "corrupt fruits," which gave the bad name to inbreeding, for they are often undesirable characters. The authors concluded that the immediate results of inbreeding naturally cross-fertilized organisms are disastrous because of the reduction to over half or one-third of production in grains and a corresponding decrease in size of plants and rate of growth in maize.

The effects of inbreeding upon variability, according to East and Jones (1919), are more apparent in the details of plant and ear structure. Any system of inbreeding that tends to bring about a narrowing of hereditary lines gives opportunity for the deleterious recessives to manifest themselves, with a resulting tendency toward a decrease in yield.

Garber (1931) found that the most universal result of inbreeding or self-pollination is the loss of vigor in the progeny. Many plant breeders have isolated and studied several thousands of inbred strains of corn, but no one has succeeded in isolating a relatively homozygous line that is as vigorous as commercial corn. This is due perhaps to the fact that maize carries 10 pairs of chromosomes in which are contained a great number of genes. These genes, together with linkage, make difficult of achievement the isolation of a homozygous inbred strain that is as vigorous as a commercial variety, if not more vigorous.

If inbreeding is followed by the elimination of abnormal characters, vigor can be restored immediately by crossing them with another pure line. The first generation of this cross will have increased vigor and productiveness. Then inbreeding will not be injurious but beneficial to plant improvement. This principle, the elimination of unfavorable characters and retention of desirable ones, underlies the pure-line method of corn breeding.

In the present study on the effects of inbreeding Lagkit corn, it was found that the average stand of plants in each row of the F_1 inbreds was lower than that in the control. A common occurrence was the appearance of dwarf plants which, according to East and Jones (1919), are rarely capable of producing seeds from their own pollen. In the present study, however, there is an indication that dwarfness can be eliminated by continuous inbreeding.

Plants manifesting various chlorophyll deficiencies were found in the F_1 inbreds, but the deficiency was not so common in the control. There were plants with chlorophyll deficiency (white or yellow stripe) on the leaves. An entire lack of chlorophyll in the pure albino plants observed in the seedling stage enabled these plants to live only as long the supply of food in the seed was not exhausted. This chlorophyll deficiency reduced vigor because chlorophyll is important in the metabolic process.

The control had a higher yield than the inbred plants.

SUMMARY

1. A greater number of chlorophyll-deficient, dwarf, sterile or barren plants appeared in the F_1 inbred generation progeny than in the open-pollinated corn plants. The F_1 inbred plants also produced a greater number of nonmarketable ears, ears with wavy or uneven rows of kernels, and shelled and unshelled ears of lower average weight than the open-pollinated Lagkit corn plants.

2. Inbreeding in Lagkit corn should be followed by the elimination of abnormal characters in subsequent generations and by the use of the remaining good qualities for the production of F_1 hybrid seed where vigor and productiveness are enhanced.

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TABLE 1a

Comparison of the F_1 inbreds and the open-pollinated (control) Lagkit corn as to the percentage of chlorophyll-deficient plants[a]

PARENT EAR NUMBER	CONTROL	INBREDS					TOTAL
		1	2	3	4	5	
I	4	5	6	5	4	6	30
II	4	6	6	5	6	6	33
III	4	6	6	6	6	5	33
IV	3	6	7	7	6	7	36
V	3	6	6	8	7	7	37
VI	2	5	6	6	6	6	31
VII	3	3	4	4	6	4	24
VIII	3	4	4	5	4	4	24
IX	3	4	5	5	4	5	26
X	3	5	4	4	4	5	25
Total.	36	50	54	55	53	55	298
Mean[b]	3.6	5.0	5.4	5.5	5.3	5.5	

[a] The percentage was based on 100 plants picked at random in each row.
[b] L. S. M. D = 0.358

TABLE 1b

Comparison of the F_1 inbreds and the open-pollinated (control) Lagkit corn as to the percentage of sterile or barren plants[a]

PARENT EAR NUMBER	CONTROL	INBREDS					TOTAL
		1	2	3	4	5	
I	9	14	15	16	13	12	79
II	6	10	12	12	15	10	65
III	8	12	14	14	12	14	74
IV	9	13	10	10	16	12	70
V	7	9	9	11	14	8	58
VI	5	10	11	15	10	10	61
VII	6	8	12	9	11	12	58
VIII	7	12	10	10	9	14	62
IX	6	11	12	12	10	16	67
X	5	10	14	12	12	13	68
Total.	68	111	119	121	122	121	660
Mean[b]	6.8	11.1	11.9	12.1	12.2	12.1	

[a] The percentage was based on 100 plants picked at random in each row.
[b] L. S. M. D. = 1.438

TABLE 1c

Comparison of the F_1 inbreds and the open-pollinated (control) Lagkit corn as to the percentage of dwarf plants[a]

PARENT EAR NUMBER	CONTROL	INBREDS					TOTAL
		1	2	3	4	5	
I	13	22	23	18	20	17	113
II	13	24	23	18	21	20	119
III	10	25	24	17	21	20	117
IV	11	26	25	20	20	17	119
V	11	24	22	22	19	18	116
VI	9	25	20	25	20	27	126
VII	10	25	20	24	20	22	121
VIII	8	23	19	23	24	25	122
IX	10	22	18	24	26	20	120
X	9	23	26	20	27	18	123
Total.	104	239	220	211	218	204	1,196
Mean[b]	10.04	23.9	22.0	21.1	21.8	20.4	

[a] The percentage was based on 100 plants picked at random in each row.

[b] L. S. M. D.= 2.372

TABLE 1d

Comparison of the F_1 inbreds and the open-pollinated (control) Lagkit corn as to the percentage of ears with zigzagging rows of kernel[a]

PARENT EAR NUMBER	CONTROL	INBREDS					TOTAL
		1	2	3	4	5	
I	38	43	46	45	41	46	259
II	36	45	48	46	46	50	271
III	38	46	34	51	58	46	273
IV	40	51	50	46	46	51	284
V	35	40	41	38	40	43	237
VI	26	30	32	34	33	36	191
VII	32	40	37	42	45	40	236
VIII	29	34	36	38	38	32	207
IX	30	37	34	36	38	34	209
X	34	42	38	45	46	45	250
Total.	338	408	396	421	431	423	2417
Mean[b]	33.8	40.8	39.6	42 1	43.1	42.3	

[a] The percentage was based on 100 ears picked at random in each row.

[b] L. S. M. D. = 2.577

TABLE 2a

Mean height in centimeters of 25 plants in the parent and F_1 inbred Lagkit corn

PARENT EAR NUMBER	CONTROL	INBREDS				
		1	2	3	4	5
I	125.20	73.04	93.20	97.08	98.48	97.76
II	119.76	96.36	101.36	89.48	94.04	95.88
III	123.32	88.88	100.92	100.80	96.36	94.32
IV	122.56	100.08	108.40	96.64	100.64	95.12
V	113.12	101.76	112.64	89.92	86.96	108.52
VI	126.52	97.16	97.56	100.12	92.04	96.36
VII	100.72	91.92	89.80	85.72	84.92	81.60
VIII	96.76	87.84	86.24	85.31	83.20	86.88
IX	119.04	91.32	110.32	103.96	98.84	109.76
X	107.16	100.00	93.76	97.12	99.84	101.04
Total..	1158.16	818.36	994.20	946.20	935.32	972.84
Mean[a]	115.81	81.83	99.42	94.62	93.53	97.28

[a]L. S. M. D. = 4.52

TABLE 2b

Mean length in centimeters of 25 ears produced by the parent and F_1 inbred Lagkit corn

PARENT EAR NUMBER	CONTROL	INBREDS				
		1	2	3	4	5
I	7.44	4.94	5.44	7.06	5.24	5.56
II	9.18	8.74	8.72	7.22	9.08	7.68
III	9.02	7.02	8.18	7.20	8.00	7.04
IV	8.64	6.80	7.80	6.64	7.54	7.30
V	10.16	9.80	10.08	8.24	8.30	8.76
VI	11.38	8.94	8.54	9.36	8.02	9.22
VII	8.82	8.48	6.24	7.14	7.72	8.58
VIII	8.16	6.96	7.92	7.36	7.78	6.58
IX	8.90	8.12	7.16	7.20	7.66	7.56
X	9.20	6.76	7.40	8.48	6.70	6.96
Total .	90.90	76.56	87.48	75.90	76.04	76.24
Mean[a]	9.09	7.65	8.75	7.59	7.60	7.62

[a]L. S. M. D. = 0.231

TABLE 2c

Mean diameter in centimeters of 25 ears produced by the parent and F_1 inbred Lagkit corn

PARENT EAR NUMBER	CONTROL	INBREDS				
		1	2	3	4	5
I	3.72	2.94	3.34	3.46	3.56	3.46
II	3.90	3.68	3.74	3.30	3.74	3.62
III	3.82	3.26	3.58	3.46	3.52	3.48
IV	3.88	3.50	3.66	3.40	3.76	3.62
V	3.88	3.84	3.58	3.80	3.34	3.54
VI	4.02	3.62	3.52	3.72	3.52	3.72
VII	3.68	3.74	3.38	3.36	3.46	3.60
VIII	3.50	3.24	3.46	3.38	3.32	3.42
IX	3.70	3.62	3.42	3.48	3.42	3.54
X	3.70	3.66	3.46	3.50	3.34	3.34
Total.	37.80	35.10	35.14	34.86	34.96	35.34
Mean[a]	3.78	3.51	3.51	3.49	3.49	3.53

[a]L. S. M. D. = 0.1976

TABLE 2d

Mean weight in grams of 25 unshelled ears produced by the parent and F_1 inbred Lagkit corn

PARENT EAR NUMBER	CONTROL	INBREDS				
		1	2	3	4	5
I	31.20	12.76	12.70	21.04	17.38	17.64
II	41.10	35.02	25.56	32.00	39.34	31.70
III	40.72	22.92	37.86	30.78	31.44	27.04
IV	42.24	22.62	34.66	24.80	36.80	35.32
V	51.08	43.86	34.12	30.86	37.16	37.18
VI	52.72	28.40	27.90	31.12	33.56	33.58
VII	25.42	24.20	13.34	21.10	25.40	25.40
VIII	23.00	13.04	21.18	18.62	13.76	23.76
IX	29.52	26.66	23.80	20.58	22.54	22.54
X	35.46	14.96	17.42	20.92	12.80	15.20
Total.	372.46	245.44	250.54	241.82	270.18	269.36
Mean[a]	37.24	24.54	25.05	24.18	27.01	26.93

[a]L. S. M. D. = 7.43

TABLE 2e

Mean weight in grams of grains from 25 shelled ears produced by the parent and F_1 inbred Lagkit corn

PARENT EAR NUMBER	CONTROL	INBREDS				
		1	2	3	4	5
I	24.18	9.80	9.48	16.16	13.08	13.00
II	34.42	27.34	18.80	16.48	30.08	24.20
III	31.84	16.36	28.88	23.28	23.62	20.22
IV	33.24	16.62	25.84	18.44	28.68	27.88
V	36.92	36.04	14.54	28.06	18.60	29.92
VI	43.54	21.96	23.78	23.78	16.02	25.42
VII	18.98	18.34	11.26	15.42	17.76	18.74
VIII	16.52	10.50	15.80	13.82	13.10	10.22
IX	22.40	20.28	17.86	15.74	19.38	16.60
X	27.84	10.02	12.66	15.88	9.46	11.12
Total.	279.88	187.24	178.90	187.06	189.78	197.32
Mean[a]	27.98	18.72	17.89	18.70	18.97	19.73

[a] L. S. M. D. = 4.63

TABLE 3

Consolidated table based on variance analyses showing the effects on the first generation of inbreeding Lagkit corn

CHARACTER	TYPE	GENERATION F_1	STATISTICAL DIFFERENCE
		average	
1. Chlorophyll deficiency in plants, per cent	Inbred	5.3	
	Control	3.6	Highly significant
2. Sterility or barrenness in plants, per cent	Inbred	11.9	
	Control	6.8	Highly significant
3. Dwarfness in plants, per cent	Inbred	21.8	
	Control	10.4	Highly significant
4. Zigzagging rows of kernel in ears, per cent	Inbred	41.6	
	Control	33.8	Highly significant
5. Height of plants, cm	Inbred	93.33	
	Control	115.81	Highly significant
6. Length of ears, cm	Inbred	7.64	
	Control	9.09	Significant
7. Diameter of ears, cm	Inbred	3.50	
	Control	3.78	Significant
8. Weight of grains from shelled ears, grains	Inbred	25.54	
	Control	37.24	Highly significant
9. Weight of unshelled ears, grains	Inbred	18.80	
	Control	27.98	Highly significant

INTER-GENERIC GRAFT AFFINITY OF THE LANZONES, *LANSIUM DOMESTICUM* CORREA[1]

LEON G. GONZALEZ AND FLORANTE CRUZ SALVADOR
Of the Department of Agronomy

Owing to the slow rate of growth of the lanzones and to its slowness in coming into bearing age, sometimes exceeding fifteen years, its grafting affinity with other closely related plants as stock was determined in the pomology nursery of the Department of Agronomy from November, 1948, to February, 1950. In regard to lanzones relatives, Merrill (1923) listed eighteen genera with 138 species under the family Meliaceae, ten genera of which may be found locally, six endemic and four introduced. There is, therefore, a wide field from which a possible stock may be found for the lanzones, considering only its near-relatives.

As to fields of study in lanzones, Mendiola (1922) suggested the selection and the breeding aspects of the fruit. He mentioned various unsuccessful attempts to graft the lanzones on santol seedlings. Working on the propagation of the lanzones by marcottage and stem cuttings, Polo (1926) obtained marked hastening of root formation in the marcots by the application of a weak concentration of potassium permanganate before covering the marcots with soil. Ilarina[2] worked on the influence of bottom heat in rooting lanzones cuttings. The first case of successful cleft-grafting of the lanzones was made in 1926, under the direction of Professor J. E. Higgins, then head of the Department of Agronomy (Gonzalez, 1934). Additional experiments in marcotting the lanzones was published by Esguerra (1927), and the performance of the lanzones interplanted with coconuts was reported by Punzalan (1927). Gonzalez (1934) reported that cleft-grafting of seedlings two to three years old was the most successful method of asexual propagation. Shield budding failed, and bark-grafting of five- to ten-year-old seedlings gave a percentage of success too low to be of practical value. In 1935, Mariano observed that fertilizers hastened the growth and development of young lanzones plants. In 1940, Luis Locsin found that of the many different kinds of near-relatives tested, only himamau, *Dysoxylum floribundum* Merr., resulted in a living union with the lanzones.[3]

Outside of the lanzones, successful inter-generic grafts were obtained in the College with *Rollinia deliciosa* Safford and *Anona glabra* Linn. (Gonzalez, 1934), and *Atalantia citroides* Pierre and *Citrus* spp. (Llana)[4].

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[1]Experiment Station Contribution No. 1556. From the thesis presented by the junior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, April, 1950, No. 1667. Prepared in the Department of Agronomy under the direction of the senior author.

[2]ILARINA, ESTANISLAO I. Propagation of certain fruit plants by stem cuttings with special reference to the bottom heat. (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture, 1931. Unpublished).

[3]Unpublished notes of the senior author.

[4]LLANA, SANTOS G. *Atalantia citroides* Pierre as stock for some species of citrus. (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture, 1944. Unpublished).

Successful unions of plants belonging to different families were reported by Nickell (1948) who obtained true vascular connection of *Mellilotus alba* (Leguminosae) and *Helianthus annuus* (Compositae), and *Mellilotus alba* and *Nicotiana tabacum* and Simon (1930) who secured a graft between *Solanum melongena* (Solanaceae) and *Iresine lindenii* (Amaranthaceae). Roberts (1949) cited Herbert (1927) who reported a natural graft of a monocot and a dicot, although no vascular connection was formed in the union.

As to physiological effects of the union of stock and scions, Roberts (1949) cited Grubb who noted changes in time of blossoming of apples and plums, Pound who reported invigorating effect of graftage in budded and grafted cacao, and Varma who noted hastened production of fruit on mango graft. Roberts (1949) added that one of the uses of grafting recently discovered is to induce flowering by transferring through approach-grafting method an unidentified substance from a flowerplant (the donor) to a non-flowering plant (the receptor) of the same species. Roberts (1949) also stated that Smith found two strains of a variety of apricot which had an unequal degree of compatibility with a single variety of stock, and two strains of a variety of apple.

EXPERIMENTS, RESULTS AND DISCUSSION

In this experiment, 84 balled two-year-old meliaceous stocks from Mount Maquiling and vicinity, 22 five-year-old meliaceous stocks in the nursery, and 128 lanzones seedlings about 30 centimeters in height were used.

Eighty-four seedlings of twenty species belonging to seven genera[5] of the family Meliaceae were balled from their habitat and planted in nursery rows one meter apart. When the meliaceous seedlings had been fully established, they were inarched with lanzones seedlings of the same size and age from the pomology nursery. The older stocks were topworked by cutting the trees one foot from the ground and graftinarched with two to five lanzones seedlings. Shoots from the topworked stocks were also inarched with lanzones seedlings. Inarching, instead of the usual grafting, was used to insure more favorable conditions for union. Particular attention was devoted to santol, *Sandoricum koetjape* (Burm. f.) Merr. because of its abundance, fast growth, early bearing, and easy propagation. The inarching was done during the wet season to minimize the need of watering the plants.

The inarched plants were given six to twelve months to get united before they were cut. The lanzones scions were severed from their root-stocks from below the point of attachments and the meliaceous stocks, from above the point of union. All wounds were painted with an asphalt-kerosene mixture after cutting. The newly inarched plants were placed under shade for a month to minimize evaporation. They were then gradually transferred to the open and observed for rate of growth and other behavior.

According to Professor Calixto Mabesa of the College of Forestry, ten genera of Meliaceae are now found in Mount Maquiling and vicinity, two

[5]The authors are indebted to Mr. Mamerto Sulit of the National Museum for identifying the plants, and to Professor Calixto Mabesa of the College of Forestry for helping in the procurement and description of these plants.

of which were secured from other parts of the Philippines, two introduced from South America, and another from China. He also states that of 138 species of Meliaceae distributed among ten genera 34 are endemic to Mount Maquiling and seven are introduced. Of these, eight genera, including twenty species, were included in this study.

The plants used as rootstocks for Lanzones were: *Aglaia diffusa* Merr., *A. iloilo* (Blanco) Merr. var. *ampla* Merr., *A. ilanosiana* C. DC., *A. langlassei* C. DC., A. *rimosa* (Blanco) Merr., *Aphanamixis cumingiana* (C. DC.) Harms, *Cedrella odorata* Linn., *Chisocheton cumingianus* (C. DC.) Harms, *C. pentandrus* (Blanco) Merr., *Dysoxylum aborescens* (Blume) Merr., *D. altissimum* Merr., *D. cumingianum* C. DC., *D. decandrum* (Blanco) Merr., *D. euphlebium* Merr., *D. floribundum* Merr., D. *hexandrum* Merr., *D. turczanowii* C. DC., *Melia azedarach* Linn., *Sandoricum koetjape* (Burm. f.) Merr., and *Toona calantas* Merr. and Rolfe.

Not one of the five species of *Aglaia* tested combined with lanzones.

With *Aphanamixis*, only one species, *A. cumingiana* could be secured owing to the size of the plants available. Only a few full-grown trees of *A. perrottetiana* Juss. could be found in Mount Maquiling, but they were not easily accessible.

Similar reports may be given of the two species of *Chisocheton: C. cumingianus* and *C. pentandrus.*

The genus *Dysoxylum* was represented by eight species. Three species continue to have living scions up to the present time, four months after cutting. They are *D. altissimum*, *D. cumingianum* and *D. floribundum.* The union of lanzones with *D. floribundum* was previously observed by Locsin in 1940.[6] The other two species tested which did not unite with lanzones were *D. aborescens* and *D. octandrum* (Blanco) Merr.

Of *Melia,* only *M. azedarach* was available. The seedlings of this species appeared too soft-wooded to be a stock for the lanzones. One top-worked stock died before the time for severance. All the scions died within six days after cutting.

Twenty inarchings with santol, *Sandoricum koetjape*, as stock were made: five seedling-to-seedling inarchings of the same age and size, five graftinarchings of old trees, five inarches using young vigorous shoots, and five double inarches with the main trunk of the stock and young shoots at the same time. In this study, both the scion and the stock were living and remained in contact until after a year, when the scion was severed from its rootstock.

Toona calantas the only species of the genus *Toona* used in the study, did not successfully combine with the lanzones despite promising signs during the inarching period.

Of the control plants, lanzones with lanzones, no difficulty of union was noticed, and the inarches could be severed after ninety days without special care and without a single casualty.

The size and age of stocks used could not have exerted much influence on the ultimate union of stocks and scions in the experiment, because even admitting the adverse influence of size and age, union should have been effected in the extraordinarily long period of time provided for, if the stocks

[6]Gonzalez, L. G., *op. cit.*

and the scions were compatible. Other factors, such as climate and other adverse conditions, could not have had any marked influence on the plants, since they were given intensive care during the experiment.

In view of the apparent compatibility with the lanzones of the three species of *Dysoxylum* just mentioned, information on them from Merrill's *Enumeration of Philippine Flowering Plants* and from Professor Mabesa are hereby reproduced. Kuling-baboy, *Dysoxylum altissimum*, is endemic to the Babuyan Islands, Luzon (Cagayan, Apayao, Quezon, Bataan, Laguna), Polillo, Samar, and Panay. It thrives in primary forests at low and medium altitudes. It attains a diameter up to 35 centimeters and a height of 10 meters. Himamáu, *Dysoxylum floribundum*, is endemic to forest ravines having altitudes of 1300 to 1500 meters in Bontoc and Benguet. It attains a diameter up to 60 centimeters and a height of 20 meters. Like kuling-baboy, himamau grows high before sending out branches. It is noted that the fruits of these meliaceous species are not eaten by birds and monkeys.

In view of the economic importance of the lanzones, as well as the scientific value of the study, it is recommended that further studies be made with the use of other kinds of near-relatives and even of stocks belonging to different families. It should be remembered that in a problem of this nature it takes a long time to demonstrate successful union. In the case of the live oak-post oak graft, incompatibility did not begin to manifest itself until after seventeen years (Armstrong and Brison, 1949). Before that time the growth behavior of the plant was described as normal.

SUMMARY

1. This study was undertaken with the object of discovering a stock for lanzones better than its own roots for hastening bearing and improving production. Inarching was the form of propagation selected to insure more favorable conditions for union.

2. One hundred twenty-eight inarches were prepared, using healthy, well-established meliaceous plants from two-year-old to full-grown trees. Of the different stocks tested, only three species, all of the genus *Dysoxylum*, resulted in living grafts with the scions severed months ago from their original roots. They were *D. altissimum*, *D. cumingianum* and *D. floribundum*. The rest of the stocks tried proved incompatible; the scions dried six days after severance from their own roots.

Further studies and long-time observations to determine the value of stocks are needed. Further tests with the compatible *Dysoxylum* stocks and with those of other species not yet tested should be made.

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GROWTH AND MATURITY OF THE FIRST-GENERATION PROGENY OF NEW HAMPSHIRE AND S. C. WHITE LEGHORN CHICKENS IMPORTED FROM THE UNITED STATES[1]

Mariano A. Sandoval

The Philippine Government imported 100,000 baby chicks from California, U. S. A., during the latter part of 1946. From the last shipment, December, 1946, the College bought 600 chicks, 200 New Hampshires and 400 Single Comb White Leghorns, for observation of their behavior under local environment. This paper reports the results of studies made in the Department of Animal Husbandry from December 15, 1947, to December 31, 1948, on the growth and maturity of the first-generation progeny of the New Hampshire and Single Comb White Leghorn pullets raised from these imported chicks.

MATERIALS AND METHODS

A total of 830 chicks artificially hatched from the eggs laid by pullets raised from the imported chicks were used in this study. Of these chicks, 415 were New Hampshires and 415 were Single Comb White Leghorns. The chicks in each breed were observed separately for a period of twelve weeks. The pullets weaned were observed up to the laying of their first egg.

The College standard rations for brooding chicks and for rearing stock were used. The former was used until all the chicks were 12 weeks old, and the latter from weaning age until the laying of the first egg. The rations used were composed of the following ingredients, all parts by weight:

Ingredients	Brooding	Rearing
Fine rice bran	55	40
Ground corn	20	10
Copra meal	5	30
Shrimp meal, or fish meal	20	20

Each lot was raised in separate, identical pens with concrete floor. Rice hulls were used as litter. Each pen had an adjoining ground run. During the first three weeks, the chicks were placed at night in the unheated brooding compartments of the pens. In the succeeding weeks, they were allowed to roost on low perches provided for them. After weaning, the pullets were transferred to laying pens with adjoining runs.

The feed was given in the form of dry mash in feeding troughs kept open to the birds at all times of the day. The birds were given chopped green feeds from the time they were three weeks old until the end of the experiment. The chicks were subjected to the same care and management during the entire period of observation.

[1]Experiment Station Contribution No. 1557. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1949. Prepared in the Department of Animal Husbandry under the direction of Professor F. M. Fronda.

The chicks were weighed 24 hours after hatching and every week thereafter until 12 weeks old. Weighing was done on an "Ohaus" balance with a maximum capacity of two kilograms and accurate to one-tenth gram. Records of the amount of feed consumed during the brooding period and mortality were also kept.

RESULTS AND DISCUSSION

Growth. The weights of the chicks at different ages were used as a measure of growth. The average weekly weights of the New Hampshire and Single Comb White Leghorn chicks are shown in table 1. This table shows that there was not much difference in the initial weights of the chicks of each breed in the three settings. In both breeds, the average initial weights were more than doubled after the second week. At the end of 12 weeks, the New Hampshire chicks had the average weights of 273.0 ∓ 16.26 grams in the first setting, 599.6 ∓ 22.67 grams in the second, and 535.6 ∓ 29.37 grams in the third. These mean weights were less than those reported by Fronda, Castillo, and del Rosario (1949). At the weaning age of twelve weeks, the Single Comb White Leghorn chicks weighed 252.9 ∓ 22.35 grams in the first setting, 553.8 ∓ 40.03 grams in the second, and 427.3 ∓ 25.55 grams in the third. These mean weights were less than those reported by Fronda and Yñiguez (1936), Castillo (1949), and those by Kempster (1941) and Jull (1943) in the United States.

In both breeds, the chicks raised in the second and third settings were consistently heavier than those of the first setting. The weight of the chicks of both breeds in the first setting was much lower than those of the second and third settings. This may be ascribed to the influence of the typhoon "Jean" on December 26-27, 1947, which occurred when the chicks in this setting were two weeks old. The chicks were soaked and many of them died of exposure. This calamity adversely affected the vitality of the birds such that they were much smaller than those of the other sets of comparable ages.

In both breeds, a marked increase in weight was attained during the last four weeks of the brooding period. This observation corroborates that of Kempster (1941) who reported that the greatest gains were made at the age of nine to twelve weeks. The New Hampshire chicks in the second and third settings registered a significant increase in weight from the ninth week, which predominantly continued up to the twelfth week. At this age, the New Hampshire weanlings had an average weekly gain in weight of 27.9 ∓ 4.67 grams in the first setting, 101.5 ∓ 5.58 grams in the second, and 88.3 ∓ 5.81 grams in the third; the Single Comb White Leghorn chicks had an average weekly gain of 27.3 ∓ 1.93 grams in the first setting, 84.3 ∓ 8.18 grams in the second, and 62.2 ∓ 4.77 grams in third.

Table 2 presents the percentage rates of growth of the two breeds. Computations were made according to the following formula of Asmundson and Lerner (1942):

$$\text{Rate} = \frac{W_2 - W_1}{\frac{1}{2}(W_2 + W_1)} \times 100$$

W_2 represents the body weight at the end of the period considered, and W_1 the weight at the beginning of the period.

This table shows that from the first day to the twelfth week, the New Hampshire and Single Comb White Leghorn weanlings in the second and third settings had better growth rates than those in the first. On the twelfth week, all the chicks dropped in their growth rates. This drop was expected, as the chicks were then older and the period of the most rapid growth had already passed. In this study the growth rates of Single Comb White Leghorn chicks in all the settings from the second to the eighth week were less than those reported by Castillo (1949).

The New Hampshire weanlings in all the settings had slightly better growth rates than the Single Comb White Leghorn chicks. At the weaning age of twelve weeks, the New Hampshire chicks had a percentage growth rate of 153.97 per cent in the first setting, 177.28 per cent in the second, and 174.80 per cent in the third. On the other hand, the Single Comb White Leghorn chicks had a percentage growth rate of 151.73 per cent in the first setting, 176.79 per cent in the second, and 171.48 per cent in third setting. The inconsistency of the growth rates in all the settings may be ascribed to the occurrence of typhoons and diseases and to the necessity of modifying rations at times by force of circumstances.

Food consumption. The amount of feed consumed by the birds in each setting computed on the basis of 100 chicks is shown in table 3. At the age of twelve weeks the New Hampshire chicks had an average consumption of 285.9 ∓ 50.20 kilograms in all the three settings and the Single Comb White Leghorns, 253.4 ∓ 41.14 kilograms. The Single Comb White Leghorn chicks consumed an average of 32.55 kilograms less feed than the New Hampshires. The birds of both breeds in the first setting consumed less feed than those of the second and third settings. These results were expected, as the weanlings in both breeds in this setting were much smaller than those of the other two settings.

When the amount of feed required to produce 100 kilograms of gain was considered, it was observed that the New Hampshire chicks in the first setting required 787.8 kilograms, 625.7 kilograms in the second setting, and 635.6 kilograms in the third setting, or an average of 683.0 kilograms in the three settings. The Single Comb White Leghorn weanlings needed 810.1 kilograms in the first setting, 606.9 kilograms in the second setting and in the third setting, 684.5 kilograms, or an average of 700.3 kilograms in the three settings. These figures show that the New Hampshire chicks required a little less feed to produce 100 kilograms of gain than the Single Comb White Leghorn chicks. If the setting which required the least feed to produce 100 kilograms of gain is considered the most efficient, the relative efficiency of both breeds in the second setting is 100 per cent. The New Hampshire weanlings in the first setting were 79.42 per cent, and in the third setting, 98.44 per cent efficient.. The Single Comb White Leghorn chicks were 74.92 per cent and 88.66 per cent efficient in the first and third settings, respectively.

Mortality. Mortality was high in both breeds from the second to the fifth week (table 4). The mortality among the New Hampshire weanlings during the 12-week period in the first setting was 85.0 per cent; in the second setting, 68.38 per cent; and in the third setting, 57.0 per cent, or an average of 70.13 ∓ 8.12 per cent in the three settings. Among the Single Comb White Leghorn chicks, the mortality in the first setting was 93.13 per cent,

85.80 per cent in the second, and 63.0 per cent in the third setting, or an average of 80.64 ∓ 9.07 per cent in the three settings. These figures indicate that both breeds in the first setting had higher percentages of mortality than in the other two sets; this was due to the typhoon "Jean" on December 26-27, 1947, and to chicken pox and roup which broke out during the fourth week of the experimental period. Between the two breeds, however, there was no significant difference in the percentage of mortality, although the Single Comb White Leghorn chicks in all the settings had apparently higher percentages of mortality than the New Hampshires.

Weights of weanling males and females. Table 5 shows the average weights of males and females of both breeds at hatch and at twelve weeks of age. At hatch the New Hampshire males and females had average weights of 36.2 ∓ 0.66 grams and 36.1 ∓ 0.40 grams, respectively; at the twelfth week the males had an average weight of 610.0 ∓ 38.89 grams, and the females, 471.2 ∓ 19.98 grams. These results were less than those reported by Tepper (1939) and Kempster (1941). In the case of the Single Comb White Leghorn chicks, at hatch the males and females registered average weights of 34.6 ∓ 0.63 grams and 33.6 ∓ 0.39 grams, respectively. At the twelfth week of age the males had an average weight of 518.6 ∓ 34.99 grams and the females, 403.4 ∓ 26.42 grams. Kempster (1941) reported that at the age of twelve weeks, in ten-year hatches, Single Comb White Leghorn pullets weigh, on the average, 1.67 pounds (0.76 kgm.).

Sexual maturity. Sexual maturity among birds is indicated by the laying of the first egg. In this study, the New Hampshire pullets laid their first eggs at the average age of 267.4 ∓ 8.13 days. On the other hand, the Single Comb White Leghorn pullets laid their first eggs when they were 220.3 ∓ 11.42 days old. It will be noted (see also table 6) that the Single Comb White Leghorn pullets laid their first eggs much earlier than the New Hampshire pullets, with a significant difference of 47.1 ∓ 14.02 days. The New Hampshire pullets laid their first eggs from 180 to 300 days of age, and the Single Comb White Leghorns from only 152 to 265 days. These results show that both breeds laid their first eggs at much later dates than those reported in the United States by Jull (1943), who sets a standard of 150 days sexual maturity for Single Comb White Leghorns and 170 days for general-purpose varieties.

In the Philippines, on the other hand, Castillo (1949) reported that the Single Comb White Leghorn pullets raised from the chicks imported in 1946 laid their first eggs at an average of 168 days. In their studies on the same stock, Fronda, Castillo, and del Rosario (1949) observed that the New Hampshire pullets laid their first eggs when 158 days old, on the average. The first-generation progeny of the New Hampshire and Single Comb White Leghorn pullets imported from the United States, therefore, laid their first eggs much later than the original stock.

As may be expected, the New Hampshire pullets were significantly heavier at maturity than the Single Comb White Leghorn pullets. The New Hampshire pullets weighed an average of 1942.3 ∓ 66.26 grams, and the Single Comb White Leghorns, 1428.5 ∓ 32.98 grams. The first ten eggs laid by the New Hampshire pullets averaged 53.7 ∓ 0.34 grams. These eggs were significantly heavier than those of the Single Comb White Leghorn eggs which averaged only 44.6 ∓ 0.62 grams.

SUMMARY AND CONCLUSIONS

1. The results of this study show that at weaning age, the first-generation progeny of the New Hampshire pullets weighed 273.0 ∓ 16.26 grams in the first setting, 599.6 ∓ 22.67 grams in the second setting, and 535.6 ∓ 29.37 grams in the third setting. The Single Comb White Leghorn weanlings weighed 252.9 ∓ 22.35 grams in the first setting, 553.8 ∓ 40.03 grams and 427.3 ∓ 25.55 grams in the second and third settings, respectively.

2. To produce 100 kilograms of gain, the New Hampshire chicks needed an average of 683.0 kilograms of feed and the Single Comb White Leghorns, 700.3 kilograms. The difference was not significant.

3. The difference in percentage of mortality between the two breeds was insignificant, although the Single Comb White Leghorn chicks had a higher percentage of mortality than the New Hampshires.

4. This study shows that the first-generation progeny of the two breeds imported from the United States laid their first eggs much later than the original stock. The New Hampshire pullets required an average of 267.4 days to mature, and the Single Comb White Leghorns required 220.3 days.

5. At maturity, the New Hampshire pullets had an average weight of 1942.3 ∓ 66.26 grams, and the Single Comb White Leghorns, 1428.5 ∓ 32.98 grams.

6. The first ten eggs laid by the New Hampshire pullets weighed 53.7 ∓ 0.34 grams, on the average, and those of the Single Comb White Leghorns, 44.6 ∓ 0.62 grams.

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TABLE 1

Average weekly weights of New Hampshire and S. C. White Leghorn chicks

Age	New Hampshires						S. C. White Leghorns					
	First setting		Second setting		Third setting		First setting		Second setting		Third setting	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
		grams		*grams*		*grams*		*grams*		*grams*		*grams*
1 day	160	35.5 ± 0.31	155	36.1 ± 0.20	100	36.0 ± 0.27	160	34.7 ± 0.22	155	34.1 ± 0.10	100	32.8 ± 0.26
1 week	148	47.4 ± 0.51	133	48.4 ± 0.53	97	44.6 ± 0.44	131	47.7 ± 0.51	88	45.7 ± 0.70	96	39.7 ± 0.46
2 weeks	117	54.0 ± 0.99	125	65.4 ± 0.96	96	59.8 ± 0.76	68	55.9 ± 1.08	67	57.0 ± 1.04	91	48.5 ± 0.78
3 weeks	88	73.9 ± 1.77	124	92.9 ± 1.42	81	75.6 ± 1.59	33	74.9 ± 3.13	59	74.7 ± 2.05	73	60.1 ± 1.29
4 weeks	55	88.8 ± 2.57	122	116.4 ± 2.16	71	90.6 ± 2.59	22	89.7 ± 4.77	56	105.4 ± 3.38	60	71.7 ± 2.14
5 weeks	45	102.9 ± 2.62	111	130.4 ± 4.15	61	112.5 ± 3.51	18	104.7 ± 5.82	55	128.6 ± 4.61	53	99.9 ± 3.94
6 weeks	40	122.8 ± 5.26	86	139.9 ± 1.41	53	147.7 ± 7.28	18	117.9 ± 7.18	50	144.3 ± 5.63	51	132.6 ± 6.08
7 weeks	37	136.8 ± 7.07	69	170.6 ± 6.29	48	193.9 ± 9.91	15	135.1 ± 9.70	42	166.3 ± 8.22	48	176.7 ± 8.18
8 weeks	34	154.4 ± 8.01	53	248.5 ± 10.18	47	241.9 ± 13.44	15	156.6 ± 13.93	36	196.2 ± 13.94	43	221.9 ± 11.19
9 weeks	31	189.1 ± 10.85	50	350.8 ± 12.02	47	297.3 ± 16.29	13	188.3 ± 17.32	24	284.4 ± 27.59	38	260.6 ± 15.02
10 weeks	28	230.1 ± 12.59	50	383.9 ± 14.10	45	361.1 ± 21.22	13	223.6 ± 21.34	22	363.9 ± 30.18	38	304.6 ± 18.87
11 weeks	28	245.1 ± 14.19	49	498.1 ± 16.96	44	447.3 ± 23.54	13	225.6 ± 21.34	22	469.5 ± 35.57	38	365.1 ± 22.64
12 weeks	24	273.0 ± 16.26	49	599.6 ± 22.67	43	535.6 ± 29.37	11	252.9 ± 22.35	22	553.8 ± 40.03	37	427.3 ± 25.55

TABLE 2

Percentage rate of growth of New Hampshire and S. C. White Leghorn chicks

AGE	NEW HAMPSHIRES			S. C. WHITE LEGHORNS		
	First setting	Second setting	Third setting	First setting	Second setting	Third setting
	per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
1 week	28.70	29.11	21.34	31.35	29.07	19.03
2 weeks	13.02	29.87	29.12	15.83	22.00	19.95
3 weeks	31.11	34.74	23.34	29.05	26.88	21.36
4 weeks	18.31	22.45	40.95	17.98	34.09	17.60
5 weeks	14.71	11.34	21.57	15.43	19.83	32.87
6 weeks	17.63	7.10	27.06	11.85	11.50	28.13
7 weeks	10.78	19.77	27.05	13.59	14.17	28.52
8 weeks	12.09	37.17	22.03	14.74	16.49	22.68
9 weeks	20.09	34.13	20.40	18.38	36.70	16.04
10 weeks	19.56	9.01	19.38	17.18	24.53	15.55
11 weeks	6.31	25.89	21.33	0.89	25.34	18.07
12 weeks	10.77	18.45	17.97	11.41	16.48	15.69
1 day – 12 weeks	153.97	177.28	174.80	151.73	176.79	171.48

TABLE 3

Amount of feed required to produce 100 kilograms of gain

ITEMS	NEW HAMPSHIRES			S. C. WHITE LEGHORNS		
	First setting	Second setting	Third setting	First setting	Second setting	Third setting
Average weight of 100 day-old chicks, kilograms	3.5	3.6	3.6	3.5	3.4	3.3
Average weight of 100 12-week-old chicks, kilograms	27.3	59.9	53.6	25.2	55.4	42.7
Average gain in weight, kilograms	23.8	56.3	50.0	21.7	52.0	39.4
Total feed consumed in 12 weeks, kilograms	187.5	352.4	317.8	175.8	315.6	269.7
Kilogram feed required for 100-kgm. gain	787.8	625.7	635.5	810.1	606.9	684.5
Relative efficiency, per cent[a]	79.42	100.0	98.44	74.92	100.0	88.66

[a]Considering the setting that required the least amount of feed to produce a unit of gain 100 per cent efficient.

TABLE 4

Percentage of mortality

ITEMS	NEW HAMPSHIRES			S. C. WHITE LEGHORNS		
	First setting	Second setting	Third setting	First setting	Second setting	Third setting
Number of chicks at the start...	160	155	100	160	155	100
Number of weanlings after 12 weeks.....	24	49	43	11	22	37
Number of chicks that died....	136	106	57	149	133	63
Percentage of mortality, per cent.....	85.00	68.38	57.00	93.13	85.80	63.00

TABLE 5

Average weights of male and female of New Hampshire and S. C. White Leghorn chicks

ITEMS	NEW HAMPSHIRES	S. C. WHITE LEGHORNS
Mean weight of males at hatch, grams.....	36.2∓ 0.66	34.6∓ 0.63
Mean weight of males at 12 weeks of age, grams....	610.0∓38.89	518.6∓34.99
Mean weight of females at hatch, grams.....	36.1∓ 0.40	33.6∓ 0.39
Mean weight of females at 12 weeks of age, grams...	471.2∓19.98	403.4∓26.42

TABLE 6

Sexual maturity of pullets raised to one year of age

ITEMS	NEW HAMPSHIRES	S. C. WHITE LEGHORNS
Number of pullets.....	38	22
Mean age when first egg was laid, days.....	267.4∓ 8.13	220.3∓11.42
Mean weight of pullets when first egg was laid, grams.....	1942.3∓66.26	1428.5∓32.98
Mean weight of the first ten eggs laid, grams.....	53.7∓ 0.34	44.6∓ 0.62

RURAL HOUSING OF ONE HUNDRED FAMILIES IN MALAKING PULO, TANAUAN, BATANGAS[1]

ANDRES P. AGLIBUT AND SILVERIO P. VILLA
Of the Department of Agricultural Engineering

A study of (a) housing conditions and problems existing in Malaking Pulo, Tanauan, Batangas, (b) plans, types of construction, and materials used, (c) relationships between house size and family size, and between income and house size, (d) different outbuildings, (e) household facilities, conveniences, and sanitation, and (f) home beautification was begun in May, 1949, and ended in February, 1950. The data obtained were analyzed and interpreted in the Department of Agricultural Engineering.

REVIEW OF LITERATURE

Carter (1938) reported that almost three fourths of the group of houses in Arkansas were built without definite planning so that many of them had excess area. The average number of rooms to a house was 4.68, and an average of 3.8 persons occupied every house. There were slightly more than 2 bedrooms to a house and 1.7 persons to a sleeping room. Most of the houses valued at $390 (₱780), on the average, had four rooms. The average floor area was 961 square feet (89.3 square meters). The average annual income of the families studied was $785 (₱1,570). He further found that as the income increased, house size increased, and as family size increased, house size also increased, the last two having a positive correlation of 0.30. Many mechanical equipment were found in the houses.

Britton (1941), in her survey of the housing of 538 Vermont families, noted that the average number of rooms to a house was 9.3 and for every person, 2.5 rooms. Ninety-one per cent of the farm houses had water in the kitchen and 31 per cent had hot and cold running water. Fifty-five per cent of the families lighted their homes with kerosene and 44 per cent with electricity. Seventy-three per cent owned radios and 40 per cent had pianos.

On the other hand, a survey of poorly housed families in Pennsylvania conducted in 1941 by John, Hiller, and Backenstose revealed that the houses were small and that 41 per cent of the families lived in dwellings with less than 1 room for a person. Ten per cent of the houses had cold running water; 4 per cent, hot running water; 36 per cent, electric lights; 3 per cent, gas or electric stoves, or refrigerators; and about half of the families owned automobiles.

In the Philippines, Sacay and Naanep (1940) reported that 83.8 per cent of the houses in a farm village in Ilocos Norte had cogon roofs, bamboo walls and bamboo floors. Only 9.5 per cent had wooden floor and walls and galvanized iron roofs. The average floor area was 48.96 square meters,

[1]Experiment Station Contribution No. 1558. Prepared from the thesis presented by the junior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, April, 1950. Prepared in the Department of Agricultural Engineering under the direction of the senior author.

providing an average space of 9.74 square meters for one person. There were 2.65 rooms to a dwelling, or 1.98 persons to a room. About 27.7 per cent of the houses had two rooms and about 64.8 per cent, three rooms. The average value of the dwellings was ₱136.08.

Fernandez[2] found in his study of the social and economic conditions of tobacco farmers in San Mateo, Isabela, that the average family income was ₱1,225.08. The houses in general had cogon roofs, boho walls, and bamboo floors. He further revealed that the average number of rooms was 2.3 to a dwelling, with an average floor area of 36 square meters. The average value of the dwellings was ₱829.93. He added that home facilities and conveniences were inadequate and beautification was given little attention.

Aglibut and Lipio (1949) studied the rural housing conditions in Añgono, Rizal, and reported that mixed materials of galvanized iron and nipa were most commonly used for roofing. About 89 per cent of the houses were erected on the owners' plan; 7 per cent, on plans prepared by other individuals; and the rest were built with plans obtained from magazines and periodicals. The average number of rooms in a dwelling was 3.29, with 1.76 persons to a room and 3.2 persons to a bedroom. The average construction cost of the dwellings was ₱435.00, but the average present value was ₱808.25. About 50 per cent of the houses had an average value of ₱292.21. The average annual family income was ₱1,292.25. The average family size was 5.8 persons. There were slight positive relationships between family size and house size and between income and house size. Modern facilities and conveniences were inadequate and the interest on the part of the inhabitants to beautify their homes was very little. More than half of the houses (56 per cent) had toilet facilities; 92 per cent used drinking water from artesian wells. Twenty-one poultry houses and 10 granaries were found in use.

METHOD OF SECURING THE DATA

One hundred houses were visited in barrio Malaking Pulo, Tanauan, Batangas. The necessary information was obtained by interviewing at random about one third of the home owners. The data collected were recorded in survey sheets which were originally prepared and subsequently revised in the Department of Agricultural Engineering. The data were then analyzed and interpreted.

RESULTS AND DISCUSSION

The locality: its industries and population

Malaking Pulo, a barrio of the municipality of Tanauan, Batangas, is located 74 kilometers south of Manila. The barrio lies 11 kilometers northwest of the poblacion of Tanauan, about 15 kilometers northwest of the town of Talisay, and about 5 kilometers east of the provincial highway. During the dry season, the barrio is accessible by about 7 kilometers of third-class road and about 4 kilometers of ordinary dirt road. It is very difficult for motor vehicles to reach it during the rainy months. The barrio has an approximate area of 600 hectares and a population of 1,682 as reported

[2]Fernandez, Gregorio C. An economic and social study of tobacco farmers in San Mateo, Isabela. (Thesis presented for graduation from the College of Agriculture, 1947. Unpublished)

in the 1949 census. The place is a rolling terrain with almost all the agricultural areas cultivated. The soil is generally clay loam. The water table is beyond the suction lift so that deep well pumps are the only means of obtaining water supply from the underground source.

Farming is the main industry of the people, rice and corn being the major crops. Vegetables are grown in between the crop seasons. Seventy-two of the families interviewed were engaged in full-time farming and 20 per cent, in part-time farming; 8 per cent were farm laborers who indirectly depended on the farm for their living. Two methods of sharing the produce were generally practiced: the 50-50 basis of expenses and harvests and the 30-70 ratio if the tenant pays for all the farm expenses. Other minor sources of income were merchandizing, sewing, seasonal employment in neighboring barrios, and other odd jobs.

Farm ownership. Forty-one per cent of the house owners owned their farms; 33 per cent were tenant farmers; 22 per cent were part-owners; and the rest, 4 per cent, did not have farms.

Size of farm. The size of the farms varied from less than 1 hectare to 22 hectares, with the most common size ranging from 1 to 2 hectares. The average size of the farms operated by the owners was 3.03 hectares; by tenant-farmers, 1.92; and by the part-owners, 3.31. The average size of the farm was 2.75 hectares

Social, educational, and economic conditions. Ninety per cent of the heads of families were born in the locality. The prevalent way of obtaining labor was the *bayani* system, which showed the close cooperation among the villagers. Social activities were rare, but the education of the children was not neglected. There was one schoolhouse where instruction was offered up to the sixth grade. The barrio had a chapel and a cemetery. Government aid and relief was generally wanting. A good road passable throughout the year would improve transportation facilities.

General housing conditions

Adequacy and efficiency of the houses. As a whole, the average value of the houses was low. They were smaller in size, built of poorer quality of materials, and more deficient in equipment and other facilities than the urban houses.

A study of floor area and distribution of rooms showed that there were, on the average, 3.72 rooms in a dwelling having a floor area of 36.5 square meters. There was an average of 4.7 persons to a dwelling, or 1.24 persons to a room, and 3.92 persons to a sleeping room. On the average, a person had 0.79 room with a floor space of 7.77 square meters.

Most of the rooms were built to serve more than one purpose. The living room, or sala, also served as bedroom, except in a few cases where a separate bedroom was provided. The room commonly found, besides the sala, was the *sulambi* which serves as dressing room, storage room, and sometimes bedroom. Twenty-two per cent of the houses had the kitchen and *batalan* combined, and 10 per cent had kitchens also used as dining rooms. Among the farmers having low income, the dwellings were also utilized for storing farm produce. Tools and equipment were usually kept under the house. There were no separate granaries, stockrooms, or storage

facilities, even in the houses of those receiving higher income; the space under the house very often served these purposes.

Planning. Seventy-four per cent of the houses were erected without plans and 19 per cent, with plans prepared by architects, carpenters, and other individuals. Seven per cent of the owners had no idea how their houses had been planned because they acquired their present dwellings through purchase.

Selection of the home sites for aesthetic reasons was not given much consideration. Most of the houses were congregated in the village for mutual protection and access to artesian wells. Usually they were built near the roads for ease and convenience in bringing in and out farm products. Drainage in the yards presented no difficult problem, since the surface run-off found its way in the lower road beds which served as drainage ways during rainy days. All of the houses faced the roads so that direction of the frontage depended on the position of the road. Thirty-two per cent of the houses faced east; 23 per cent, south; 21 per cent, west; and 19 per cent, north. The rest were facing northeast and southwest. Landscaping, contour planning, and modern home designing were lacking. The average distance between neighbors was 11.54 meters; the farthest, about 100 meters; and the nearest, about 2 meters.

Construction. Fifty-six per cent of the dwellings were built by paid carpenters. Those constructed by the owners with or without the assistance of carpenters engaged through the *bayani* system composed 37 per cent of the 100 houses visited. Owners of the rest of the houses could not tell how their houses were constructed because they had been acquired through purchase.

The most common materials used were bamboo, wood, or a mixture of wood and bamboo. Although most houses were constructed with mixed materials, classification was based on the extent (80 per cent or more) a particular material is used in the building. According to this classification, 8 per cent of the houses were made of wood; 39 per cent, bamboo; and 53 per cent, wood-bamboo. On the other hand, 26 houses had bamboo floor, stairs, walls and shutters, wooden posts, and galvanized iron roof; 18 had galvanized iron roof, wooden posts, shutters and walls, and bamboo floor and stairs; 13 had galvanized iron roof, bamboo floors, stairs, shutters and walls, and a mixture of wood and bamboo posts; 2 had galvanized iron roof and the rest of the materials made of bamboo; 2 had galvanized iron roof with the rest made of wood; and the others were made of mixed materials in different combinations.

Roof. Eighty-one per cent of the houses had galvanized iron roof; 7 per cent, mixed galvanized iron and cogon; 11 per cent, cogon; and only one per cent, combined galvanized iron and bamboo split into halves.

Walls. In most of the houses better construction materials were used in the house proper. Thirty-one per cent of the houses had wooden walls in the house proper and 21 per cent had wooden walls in the other sections. Sixty-seven per cent had wood and bamboo walls in the main house and 44 per cent had *sasag* bamboo walls for other rooms. One used plaster boards for partition walls in the bedroom and sala.

Floor. Split bamboo was used for floor in 90 per cent of the houses studied. The floors of the remaining 10 per cent were made either of wood, bamboo, or a mixture of bamboo and wood.

Posts and foundations. Almost three fourths of the dwellings had wooden posts. Bamboo or a mixture of wood and bamboo was used only in small and light houses. The average height from the ground to the floor line was 2.05 meters, and from the floor to the ceiling, 3.04 meters. Of the houses studied, only seven had their posts resting on concrete foundations; the majority had their posts buried in the ground.

Stairs. Bamboo was the most common material used for the stairs. Only 15 per cent of the houses had stairs made of wood, while one had no stairs at all. Three per cent of the dwellings had stairs resting on concrete.

Window shutters. Forty-six per cent of the houses had framed sawali (buho) for window shutters; 27 per cent, wood; 14 per cent, shell sash; the others *sasag* bamboo; and 2 per cent, none.

Door shutters. Forty-six per cent of the houses had doors made of *sasag* bamboo and 37 per cent had wood. The others were made of bamboo-wood or bamboo slats. Most of the doors had only one-piece shutters.

Ceiling. Only two of the houses had ceilings, one made of bamboo and the other, of plaster board.

Construction and repair. All houses covered in this survey were built before World War II. Fifty per cent of the houses constructed from 1906 to 1941 had not been repaired. More than three fourths of the houses were built from 1927 to 1941. The construction cost of dwellings ranged from ₱71.30 to ₱1,400, with an average cost of ₱282.57 for all dwellings. About 81 per cent of the dwellings cost from ₱71.30 to ₱300.

Present value. The change in purchasing power of money had correspondingly increased the construction cost. Despite the depreciation of the houses, their present values consequently increased considerably. Subsequent addition, repair, and improvements made on the buildings also increased their present values. The present value of the dwellings as estimated by the owners varied from ₱81.25 to ₱2,750, with an average of ₱536.20. The majority of the houses (57 per cent) had values ranging from ₱71.30 to ₱466.67.

Family size and its composition

Family size. The members of the family ranged from one to twelve, with four fifths of the families having two to six members. Twenty-three per cent of the houses had four members, the average being 4.41. The household members were as follows: children, 57.66 per cent; parents, 35.96 per cent; relatives, 3.4 per cent; 1.7 per cent single or alone in the family; and 1.28 per cent persons not related to the family. Of the 470 members of the families studied, there were slightly more females (50.21 per cent) than males (49.79 per cent)

Relation between family size and house size

A slight relationship existed between family size and house size. As the family increased in membership, the size of the house slightly increased. The number of rooms did not increase in proportion to the increase in

family size. In some cases houses were too small for the size of the family, or vice versa. An analysis of the family size and house size gave a correlation of +0.43.

Family income and size of house

Family income. The annual family income ranged from less than ₱187.50 to more than ₱2,774.00, with an average of ₱667.41. More than three fourths (77.0 per cent) of the families belonged to the following income groups: ₱201-₱400, 27 per cent; ₱401-₱600, 37 per cent; and ₱601-₱800, 13 per cent.

Relation between family income and house size. Although in a few cases some houses did not increase in size corresponding to the increase in number of family member, there was a positive correlation of 0.52 between income and house size, considering all the houses studied.

Home facilities, conveniences, sanitation, and beautification

Facilities in the home. The families studied were wanting in home facilities and conveniences. Seventy-eight per cent of the houses were provided with wooden benches; 55 per cent, bamboo benches; 30 per cent, wooden chairs; 47 per cent, wooden tables; 54 per cent, food cabinets; 46 per cent, flat iron; 61 per cent, bamboo-earth hearth; and 78 per cent, kerosene lamps. There was no electric service in the locality, but two houses had battery-operated radios.

Sanitation. Of the hundred homes studied, only three houses had sanitary privies and only one had a pit system. As expected, there was no water closet in the house on account of the absence of running water. Drainage condition, on the other hand, was not a problem except in three cases where the houses were located near water pools that accumulated some surface run-off during the rainy months. Drinking water was obtained from artesian wells throughout the year and also from rain during the rainy season. The average distance of houses from the nearest artesian well was 175.66 meters. About 88 per cent of the houses had drinking-water containers without faucet.

Beautification and ornamentation. Beautification of the home grounds in the community studied was given little attention. Hedges which were usually on the front boundary were for fencing rather than for beautifying. Some of the houses (27 per cent), however, had potted ornamental plants in the house, whereas a few had small flower gardens in front or beside the house. This may be due to the lack of abundant water for watering purposes.

Different outbuildings

Since most of the farms were far from the homes (an average distance of 1.31 kilometers), most barns and resthouses (both locally called *kubo*) were built near the farms. Farmers who did not have these structures kept their tools and equipment in neighbors' barns adjacent to their farms. There were 35 outbuildings, of which 13 were hoghouses, 12 implement shed and resthouses, 9 semi-permanent barns (*kubo*), and one poultry house.

The hoghouse. There was no regular hoghouse in the village covered by this study. There were, however, pig shelters locally called *ulbo* or *banlat*

which were generally made of bamboo, with the floor raised about one foot from the ground. The average floor area was about 4 square meters, with shed-type roof made of palm leaves or burned galvanized iron sheets. There were very few hog shelters to accommodate the hogs in the barrio, so that stray pigs were a common sight.

The barn. The barns, or *kubo*, were mostly made of bamboo and cogon roofs. They had an average size of 11.91 square meters and built at an average cost of ₱27.78. Here pigs, chickens, and work animals were raised or kept. Corrals usually had no sheds but animals were kept either under the house or nearby trees.

The poultry house. Only one family raised about thirty chickens in confinement. The walls and posts of the poultry house were made of bamboo, and the cogon roof was of the shed type. Most of the families kept their birds either under the houses or let them roost on trees at night and then left astray at daytime.

SUMMARY AND RECOMMENDATION

1. Of the one hundred rural families interviewed, 41 per cent were farm owner-operators; 33 per cent were tenants; 22 per cent were part-owners; and 4 per cent had no farms of their own but indirectly depended on others' farms for their living.

2. The average size of tenant-operated farms was 1.92 hectares; of partly-owned farms, 3.31; owner-operated farms, 3.03; and for all, 2.62 hectares.

3. The average number of rooms in a dwelling was 3.72 and 1.24 persons to a room, or 0.79 room to a person. The average floor area of the dwellings was 36.50 square meters, and that of a room was 9.81 square meters. The floor area for a person was 7.77 square meters; the number of individuals to every sleeping room was 3.92.

4. Seventy-four per cent of the dwellings were built without plans; 19 per cent had plans prepared by carpenters or architects. The plans of the remaining 7 per cent of the dwellings were not known.

5. About 53 per cent of the houses were generally made of wood and bamboo; 39 per cent, of bamboo; and 8 per cent, of wood. All of the houses surveyed had the gable type of roof. Twenty-six per cent of the houses had galvanized iron roof, wooden posts, and bamboo walls, stairs, and shutters. Eighteen per cent had galvanized iron roof, wooden posts, shutters, and walls, and bamboo floor and stairs.

6. The dwellings had an average prewar construction cost of ₱282.57, with 81 per cent constructed at a cost varying from less than ₱71.30 to ₱1,400.00.

7. The dwellings had an average present value of ₱536.20, with 57 per cent having values ranging from ₱71.30 to ₱466.67. Only 50 per cent of the houses built between 1908 and 1941 had been repaired.

8. The number of individuals in the family ranged from one to twelve; the average was 4.7. Eighty per cent of the families had between two to six members. As the size of the family increased, the size of the house also increased. There was a positive correlation of 0.43 between family size and house size.

9. The average family income was ₱667.41 a year; 77 per cent of the group earned from ₱200.00 to ₱800.00. A positive correlation of 0.52 existed between family income and house size.

10. Home beautification received little attention, and modern essential facilities and convenience were inadequate.

11. Although drainage condition was generally good, sanitation was inadequate owing to the absence of running water. Only three of the houses had sanitary privies and one had a pit system for sewage disposal. Drinking water was obtained mostly from deep well pumps. Eighty-eight per cent of the house owners had no sanitary water containers.

12. There were only 34 outbuildings, of which 13 were pig shelters, 12 implement sheds or rest houses, 9 barns (*kubo*), and one poultry house. Because of the lack of shelters for hogs and chickens, stray animals were prevalent in the village. Most of the houses were also used for storing farm produce, tools, and farm equipment on account of the lack of granaries and tool sheds.

13. An ideal farmhouse recommended for the locality surveyed should be based on the following housing conditions:

Number of persons in the family	4 to 5
Number of rooms	5
Floor space for each person, in square meters	8.8 to 11
Estimated cost	₱1,300

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TESTS OF SELECTED STRAINS OF ELON-ELON AND GUINANGANG[1]

VALERIANO C. CALMA, FRANCISCO C. REYES, AND MARCOS DE LA CRUZ
Of the Department of Agronomy

These experiments were conducted from June, 1947, to March, 1949, in the Experiment Station of the College of Agriculture at Los Baños, Laguna. The first experiment was conducted to determine the yields of three selected strains of Elon-elon and the second, those of four selected strains of Guinangang.

MATERIALS AND METHODS

Elon-elon rice strains Nos. 473, 255, and 101 selected by Cruz[2] in 1947 from the population of Elon-elon studied by Garran[3] were used.

Guinangang strains Nos. 305, 311, 234, and 426 isolated in 1947 by Mercado[4] from twenty-five strains and a stock seed were used for control.

The ordinary method of lowland rice culture was followed in raising the two crops.

RESULTS AND DISCUSSION

One month after transplanting, differences in the vigor and uniformity of the plants of the different Elon-elon strains and the control were observed. Strain 473 appeared the most vigorous but slightly less uniform than strain 101. Owing to the dry spell that followed, strain 255 exhibited reddening at the tips of the leaves. The control also showed slight reddish coloration of the leaves. The average heights of twenty plants of each strain and the control, taken at random before transplanting, were as follows: strain 101, 57.7 centimeters; strain 473, 55.6 centimeters; strain 255, 55.0 centimeters; and the control, 54.4 centimeters.

The Guinangang seedlings grew luxuriantly. They were very green because there was sufficient water in the seedbed for their growth. The four strains and the control were practically the same in their growth and vigor. The height of the seedlings of the four strains and the control ranged from 54.10 to 56.50 centimeters.

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[1]Experiment Station Contribution No. 1559; theses presented by the junior authors for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, October, 1948, and March, 1949, respectively. Prepared in the Department of Agronomy under the direction of the senior author.

[2]CRUZ, G. M. A plant-to-the-row test of 142 strains of Elon-elon rice. (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1947. Unpublished.)

[3]GARRAN, C. Initial selection of Elon-elon rice strains. (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1946. Unpublished.)

[4]MERCADO, G. Plant-to-the-row test of Guinangang rice. (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1947. Unpublished.)

Among the pests that attacked the plants of the different strains and the control was the rice stem borer, *Schoenobius incertellus* Walker. It caused the appearance of white, dried panicles with the characteristic empty grains. During the milk stage of the crop, the rice bug, *Leptocoriza acuta* Thunberg, sucked the contents of some of the grains. The red rice weaver, *Lonchura ferruginosa jagori* (Martens), likewise attacked the plants. The damage due to the birds was minimized by providing scarecrows in the field and by driving them away. As a whole, the damage attributed to all of these pests was practically negligible. Throughout the entire period of growth until harvesting time, no symptom of any disease was observed in any of the strains and the control.

In the first experiment the plants of the three strains and the control in four plots lodged after the typhoon "Jean" on December 26, 1947.

The control plot for the Guinangang lodged after the typhoon on December 26, 1947, when most of the plants were in bloom, but the four strains did not lodge at all.

All strains and the control bloomed in 136.0 days after sowing in the seedbed as reported by Cruz,[5] except strain 101 which flowered in 138.6 days.

The three strains of Elon-elon and the control matured 176.0 days after sowing, or 4.6 days later than that reported in a previous study.

Guinangang strain 426 flowered 111 days from sowing. The control flowered 114 days after sowing and matured in 145 days. All strains matured 144 days after sowing.

Elon-elon strain 473 had the greatest number of bearing culms, with a mean of 9.4; the control had the least, with an average of 7.0 bearing culms to a hill. However, the differences were insignificant, indicating that the variations were not inherent but due to plot location where the variance was significant.

Guinangang strain 311 had 17.33, the highest mean number of bearing culms in each hill and strain 305, the lowest, with 13.86. Strain 311 gave significantly more bearing culms in a hill than the other strains and the control, which gave significantly more than strain number 305. There was no significant difference in the number of bearing culms in a hill among the other strains and the control, although in the plots the differences were highly significant.

The plants of the Elon-elon strain 255 were the tallest, with a mean height of 141.3 centimeters, and the plants of the control, the lowest, with an average height of 119.2 centimeters. The variation in height of the strains was not inherent.

The plants of the control for Guinangang were taller than those of the four strains of Guinangang, but the difference between the mean height of the plants of the four strains and that of the control was insignificant. The analysis of variance due to plots was highly significant and showed great variability in the plots.

All three strains of the Elon-elon yielded higher than the control (table 1) and, when analyzed statistically, only strains 473 and 101 gave significantly higher mean yields than the control. Also, only strain 473 produced

[5] *Ibid.*

a mean yield significantly higher than that of strain 255. Strains 473 and 101 had the same yielding capacity. In a previous study in this College in 1947 by Cruz[6], strain 473 was the highest yielder among the strains selected.

The yields of the four strains of Guinangang and of the control (table 2) show that strains 234, 305, and 311 gave each a mean yield lower than the control. Strain 426 gave a higher yield in all of the plots than the control, but the differences in yield were not significant. Although Mercado[7] found that the four strains gave significantly higher yields than the control, the writers noted that these four strains are just like the control.

Based on the mean yield of each plot and on 44 kilograms to a cavan of clean palay, the four strains of Guinangang gave a computed yield ranging from 40.08 to 51.60 cavans to the hectare. Strain 234 gave 40.08 cavans; strain 311, 40.84; strain 305, 44.10; the control, 45.07; and strain 426, 51.60 cavans.

The percentages of increase in yield of selected strains of Elon-elon over the control are 52.01 for strain 473, 42.65 for strain 101, and 31.21 for strain 255. Based on the actual yield of the three strains and the control, the computed yield of strain 473 was 43.4 cavans; strain 101, 35.5 cavans; strain 255, 32.8 cavans; and the control, 25.0 cavans to the hectare. The computed percentages of empty grains determined by winnowing were as follows: strain 473, 7.0; strain 101, 11.1; strain 255, 12.4; and the control 13.1. In this respect, strain 473 had the least number of empty grains, a desirable characteristic in rice.

SUMMARY

1. Guinangang strain 311 gave significantly more bearing culms to a hill than strains 426, 234, 305, and the control. The selected strains and the parent plants of Elon-elon did not differ significantly in the number of bearing culms and height of plants.

2. Only a few pests were observed attacking the plants, and no disease was noticed on these two varieties.

3. The actual yield of the strains of Elon-elon and the control varied from 47.1 to 71.7 kilograms for each area of 450 square meters, or a computed yield of 25.0 to 43.4 cavans to the hectare. Strains 473 and 101 yielded significantly higher than the control. Strain 255 and the control were similar in their yielding capacity. In Guinangang the yield varied from an average of 25.06 kilograms to 32.23 kilograms a plot, or 40.08 to 51.60 cavans a hectare. Strain number 426 gave a higher yield and each of the other strains, a lower yield than the control.

4. Elon-elon strains 473 and 101 consistently showed their superiority over the parent variety in yield of clean palay and in percentage of empty grains.

[6] *Ibid.*

[7] *Ibid.*

TABLE 1

Comparative yield in kilograms of clean palay of the three strains of Elon-elon and the control

STRAINS	PLOTS			TOTAL	MEAN
	I	II	III		
473	18.3	24.8	28.5	71.6	23.87
101	21.0	19.6	26.5	67.1	22.36
255	17.8	19.5	21.5	58.8	19.60
Control	14.3	13.0	19.8	47.1	15.70
Total	71.4	76.9	96.3	244.6	
Mean	17.85	19.22	22.07		20.38

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	VARIANCE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Plot	2	85.55	42.77	9.40	5.14	10.92
Strain	3	115.84	38.61	8.44	4.76	9.78
Error	6	27.31	4.55	—	—	—
Total	11	228.70	—	—	—	—

L. S. M. D. = 4.25

TABLE 2

Comparative yield in kilograms of clean palay of the four strains of Guinangang and the control

STRAIN NUMBER	PLOTS			TOTAL	MEAN
	1	2	3		
234	21.4	17.8	36.0	75.2	25.06
305	31.7	19.3	28.0	79.0	26.33
311	14.5	30.9	30.6	76.0	25.33
426	31.3	31.0	34.4	96.7	32.23
Control	26.4	25.0	30.5	81.9	27.30
Total	125.3	124.0	159.5	408.8	
Mean	25.06	24.80	31.90		27.25

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	VARIANCE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Plot	2	162.10	81.05	2.28	4.46	8.65
Strain	4	122.35	30.58	0.86	3.84	7.01
Error	8	284.25	35.53			
Total	14	568.70				

PULSE RATE, RESPIRATION, AND BODY TEMPERATURE OF NATIVE CATTLE[1]

ALEJANDRO R. ALCAIDE

In the absence of data on the normal pulse and respiration of the Philippine Native ox and the limited work on the normal body temperature of this animal, local veterinarians, as well as cattle husbandmen, have to rely largely on figures that have been found to be normal in foreign countries. The practice is fraught with errors, owing to differences in size, breed, and climatic conditions.

This study was conducted in the Department of Animal Husbandry from January to December, 1949, to determine the body temperature, the pulse frequency and respiration of the Philippine Native cattle, and whether or not there are seasonal variations of the pulse rate, respiration, and body temperature.

In the United States, figures on the pulse, respiration, and body temperature of the ox vary. Udall (1922) reported that the body temperature of the ox ranges from 100.4°F. to 102.2°F. (38°C. to 39°C.), with an average of 101.4°F. (38.5°C.), and that the frequencies of its pulse and respiration are 40 to 60 and 10 to 30 per minute, respectively. According to Hadley (1920), the approximate average body temperature of the ox is 101.5°F. (38.6°C.), and the normal pulse rate is 45 to 65 a minute. Morrison (1936) reported that the normal range of the body temperature of mature cattle is 100.4°F. to 102.8°F. (38°C. to 39.3°C.), with an average similar to that reported by Hadley.

In the Philippines, Coronel (1932) reported that the average temperature of Philippine cattle was 37.56°C. in the morning and 38.57°C. in the afternoon. Manresa and Gomez (1937) reported the diurnal body temperature of the Indian Nellore breed of cattle as 38.70 ∓ 0.015°C. and the nocturnal body temperature as 38.56 ∓ 0.013°C. The body temperature of the Jersey breed of cattle in the Philippines ranged from 37.1 to 41.0°C. in the morning, with a mean of 38.46 ∓ 0.013°C. In the afternoon the body temperature of the same breed ranged from 37.5 to 41.0°C., with a mean of 38.80 ∓ 0.005°C. The range of the morning body temperature of the Holstein-Friesian breed was 37.5 to 40.6°C, with the mean of 38.69 ∓ 0.013°C. and 37.5 to 41.4°C., with a mean of 39.12 ∓ 0.006°C. in the afternoon. (Manresa and Erce, 1940).

MATERIALS AND METHODS

Five steers and five cows of mature Philippine Native cattle, belonging to the Department of Animal Husbandry, were used in this experiment. All apparently healthy, they were from five to ten years old. The males

[1]Experiment Station Contribution No. 1560. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, April, 1950, No. 1640. Prepared in the Department of Animal Husbandry under the direction of Dr. Faustino S. Mensalvas.

were older than the females. Bilukao and Kalejon, the oldest of the males, were ten years old; Kalo, Kamal, and Darazo, all males, were seven; Mabait, female, was seven; Minda and Palsara, six; and Bonkalot and Malva, five.

All the animals were given the same care and management. They were tethered and given water daily. No concentrates were fed. Salt was given regularly once a week.

The pulse rate, frequency of respiration, and body temperature of all the animals were taken on the second and fourth Sundays of every months between 8:00 and 11:00 o'clock in the morning. The pulse rate was taken on the outside of the lower jaw just above its lower border for ten seconds with a stop watch at three different times, and the average beating of the pulse was multiplied by six. This gave the pulse rate per minute. The rise and fall of the hind flanks were used to determine the respiratory rate. Three counts of a full minute each were made with the use of a hand tally counter, and the average was taken to represent the respiratory rate per minute. The body temperature was determined by inserting the veterinary clinical thermometer, graduated in degrees Fahrenheit, full length in the rectum of the animal for at least three minutes.

RESULTS AND DISCUSSION

In this study, the period from January to May was considered dry season and that from June to December, wet season.

Pulse rate. The monthly average pulse rate a minute for both sexes of the ten Philippine Native cattle used in this study varied slightly. The highest average pulse rate was obtained in August, 54.8 a minute, and the lowest was in January, 53.3 a minute. The pulse rates of the two sexes varied; the mean pulse rate of the males was 53.82 ∓ 0.278 a minute and that of the females, 54.24 ∓ 0.156 a minute, or a mean insignificant difference of 0.42.

Respiratory rate. There was a little variation in the monthly average respiratory rate of the animals. The lowest rate was 26.0 a minute in January and the highest, 29.1 a minute in May. The mean respiratory rate of the females was higher than that of the males. The average monthly respiratory rate of the males ranged from 23.6 ∓ 1.806 to 28.4 ∓ 0.600, or a mean of 26.93 ∓ 0.425 a minute. In the females, the range was 26.6 ∓ 0.244 to 29.8 ∓ 0.200, or a mean of 28.17 ∓ 0.242 a minute. The mean difference of 1.24 between the sexes is significant.

Body temperature. The monthly average body temperature of the animals varied within a limited degree. The highest body temperature was 38.65°C. during the month of May, and the lowest was 38.37°C. in February. The body temperature of the animals also varied between sexes. The mean body temperature of the males was 38.46 ∓ 0.021°C. and of the females, 38.56 ∓ 0.027°C., with a mean difference of 0.10°C. The mean body temperature of the females, when subjected to "t" test, was significantly higher than that of the males.

Kalejon had the lowest pulse rate of 52.50 ∓ 0.313 a minute and Minda, the highest, with 55.67 ∓ 0.527 a minute. As regards frequency of respiration, Darazo had the lowest with 25.00 ∓ 0.738 a minute and Bilukao the highest, with 28.67 ∓ 0.207 a minute. Mabait had the highest body tem-

perature, 38.68 ∓ 0.043°C. and Bilukao, the lowest, 38.35∓0.043°C. The mean body temperature of all the animals used in this study was 38.51 ∓ 0.043°C., which is 0.95°C. higher than the morning temperature, and 0.06°C. lower than the afternoon temperature of Philippine cattle (Coronel, 1932). This mean is close to the figures found by Udall (1922) and Hadley (1920) on cattle, and by Morrison (1936) on dairy cows in the United States. The figures found by Hadley (1920) are 0.09°C. lower than those obtained in the present study. The mean pulse rate was 54.03 ∓ 0.294 a minute and the mean respiratory rate was 27.5 ∓ 0.406 a minute.

Seasonal fluctuation. The mean pulse rate of the animals was slightly higher during the dry season, 54.040 a minute, than during the wet season, 54.028 a minute, with an insignificant difference of 0.012.

The mean respiratory rate was 27.44 a minute during the dry season and 27.63 a minute during the wet season. The mean difference in the frequencies of respiration in the dry and wet seasons is insignificant.

The mean body temperatures of Philippine Native cattle were 38.52°C. during the dry season and 38.50°C. during the wet season; the difference is insignificant.

Other observations. During the course of the study, the two horns of Kalejon dropped. In summer all the animals except Kalejon, were branded, and the horns of the males were cut at the tip. The typhoon which occurred on November 12 and 13, 1949, did not have any noticeable effect on the body temperature, pulse rate, and respiration of the animals.

SUMMARY

1. A study on the body temperature, pulse and respiratory rates of ten Philippine Native cattle was made from January to December, 1949.

2. The mean body temperature and frequency of respiration of the females were found to be significantly higher than those of the males, but there was no significant difference in the mean pulse rates of the two sexes.

3. The seasons did not have any effect on the body temperature, pulse and respiratory rates of Philippine Native cattle.

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PRODUCTION OF BROILERS FROM NEW HAMPSHIRE, LOS BAÑOS CANTONESE, AND SINGLE COMB WHITE LEGHORN BREEDS OF POULTRY[1]

José R. Mondoñedo

The breed of chicken to use is one of the most important considerations in successful broiler production. With the aim of determining the best available breed for the production of broilers under local conditions, this study was conducted in the Department of Animal Husbandry from December, 1947, to October, 1948.

MATERIALS AND METHODS

In this study, 417 baby chicks were used. A comparison was made among the Los Baños Cantonese (lot 1), New Hampshire (lot 2), and S. C. White Leghorn (lot 3) breeds. Three trials were conducted, each covering a period of twelve weeks. The chicks were legbanded and weighed to get the initial weights. Biweekly weights were taken thereafter till the close of the observation period at the age of twelve weeks.

The ration given the chicks consisted of the following ingredients, all parts by weight:

Rice bran	45
Ground corn	30
Copra meal	5
Shrimp meal, or fish meal	20

The mash was supplemented with ground shell, 3 parts per 100 parts mash, and incorporated in the mash. The mash was given dry and the chicks had access to it at all times during the day. Chopped green feed was made available to the chicks every morning. Similar feeding, care, and management were given all the lots.

The initial and biweekly weights of the individual birds, the weekly feed consumption, the mortality, and the rate of feathering were recorded.

DISCUSSION OF RESULTS

Rate of growth. Table 1 gives the initial and biweekly weights of the chicks. This table shows that the New Hampshire chicks made the heaviest gain in weight and the Los Baños Cantonese made the least. At the age of twelve weeks, the average weight of the New Hampshire chicks was 604.0 grams, that of the S. C. White Leghorn chicks, 571.4 grams, and that of Los Baños Cantonese, 508.8 grams. The difference in mean weight at this age between lots 1 and 2 and between lots 1 and 3 was found to be highly significant. Between lots 2 and 3, however, the difference was insigni-

[1]Experiment Station Contribution No. 1561. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1949. Prepared in the Department of Animal Husbandry under the direction of Professor F. M. Fronda.

ficant. Considered on the basis of weight gained from the first day to the twelfth week, lot 2 was 17.68 per cent more efficient than lot 1 and 5.71 per cent more efficient than lot 3. Lot 3 was 11.33 per cent more efficient than lot 1.

The mean weight of the Los Baños Cantonese chicks at twelve weeks was very much higher than that reported by Tioaquen (1933), which was only 460.1 grams. The weight of the S. C. White Leghorns obtained in this experiment was heavier than that reported by Tamayo[2] but very much lower than the weights reported by Kempster (1941) and Jull (1943). Baclig and Fronda (1949) reported the mean weight of New Hampshire chicks to be only 554.0 grams at twelve weeks of age, which was lighter than that obtained in this experiment.

The greatest gain in weight in all the lots was attained when the chicks had reached nine to twelve weeks. The chicks gained about half of their final weights within the last four weeks of the period. This result corroborates that of Kempster (1941) that the greatest gains were made at the age of nine to twelve weeks.

Feed consumption and feed cost. It may be seen by reference to table 2 that lot 2 consumed the least amount of feed to produce a kilogram gain. On the average, lot 2 required 5.15 kilograms feed for every kilogram gain in weight; lot 1, 5.23 kilograms; and lot 3, 5.66 kilograms, which cost ₱1.08, ₱1.10, and ₱1.19, respectively. In this regard, lot 2 was only 1.47 per cent more efficient than lot 1 and 9.86 per cent more efficient than lot 3. Lot 1 was 8.27 per cent more efficient than lot 3.

As shown in table 2, lot 2 had the greatest returns above the cost of feed. Based on 100 chicks as the starting stock, the returns above cost of feed for lots 1, 2, and 3 were ₱22.10, ₱22.76, and ₱17.08, respectively. What the Los Baños Cantonese lacked in size was made up by its greater percentage of chicks raised; hence, it gave the greater returns above cost of feed than the S. C. White Leghorns.

A producer of broilers is most interested in the income he may derive from the enterprise. Since this study was conducted under experimental conditions and not on a commercial scale, no data on labor and overhead charges could be presented which could be used as a basis for commercial purposes. The returns above feed cost, however, may be taken as a basis in determining the better breed for broiler production, inasmuch as labor and other charges would be the same for the three lots.

Proportion of chicks raised to the age of twelve weeks. The Los Baños Cantonese breed made only a slightly better showing in regard to the number of chicks that reached the age of twelve weeks than the New Hampshires which came second. The S. C. White Leghorns had the least number that survived to this age. The average percentage of chicks raised up to twelve weeks was 52.85 for lot 1, 51.3 for lot 2, and 40.0 for lot 3. These figures show that the New Hampshire breed, although recently introduced in this country, was very close to the Los Baños Cantonese and was much better than the S. C. White Leghorn.

[2]Tamayo, M. R. 1934. A comparative study of the growth and development of the cross between a S. C. White Leghorn rooster and Los Baños Cantonese hens. (Thesis presented for graduation from the College of Agriculture, 1934. Unpublished). *Cited by* Fronda, F. M., and B. T. Yñiguez, 1936. A comparative study of five different breeds of poultry. Philippine Agriculturist **25**: 105–119.

The heaviest mortality in trial 1 occurred from the third to the sixth week. The typhoon "Jean" of December 25-26, 1947, and the incidence of chicken pox in the third week may account for the heavy mortality. The S. C. White Leghorns, an egg breed characterized by its nervous temperament, suffered the heaviest loss, the mortality being 81.0 per cent. Lots 1 and 2 had a mortality of 64.8 and 73.0 per cent, in the order given. Five cases of cannibalism, which caused the death of four chicks, were observed in lot 1 in the first trial between the eighth and the eleventh week.

The incidence of chicken pox and roup, which appeared almost at the same time during the third week of the second trial, caused the heavy mortality in the later periods. Cases of roup and what appeared to be coccidiosis appeared in the third trial but were not so severe as in the previous trials. In all cases, the S. C. White Leghorns appeared to be the most susceptible to diseases and the most easily affected by adverse conditions and the Los Baños Cantonese, the least affected.

Other observations. The rate of feathering is also used as a criterion in the selection of broiler fowls. According to Williams and Jull (1943), the objection to late-feathering birds at marketing time is that there are numerous pin feathers left after plucking. This may mean a reduction in price in discriminating markets. Although lot 1 started to feather about the third week of the experiment, one week later than lots 2 and 3, all lots were observed to be fully feathered on the twelfth week.

The New Hampshire chicks were observed to be the most docile and manageable; the S. C. White Leghorns were easily frightened and therefore hard to manage. Intermediate between these two breeds stood the Los Baños Cantonese.

SUMMARY AND CONCLUSION

1. At twelve weeks of age the New Hampshire weanlings were significantly heavier than either the S. C. White Leghorns or the Los Baños Cantonese.

2. The New Hampshire weanlings required the least amount of feed to produce a kilogram gain in weight and S. C. White Leghorns, the most. This breed gave the highest returns above cost of feed; the Los Baños Cantonese, second; and S. C. White Leghorns, third.

3. The Los Baños Cantonese and New Hampshire chicks suffered about the same mortality, which was considerably lower than that of the S. C. White Leghorns.

4. Although the Los Baños Cantonese chicks started to feather about one week later than the New Hampshires and S. C. White Leghorns, all breeds were fully feathered at the age of twelve weeks.

5. On the basis of the results obtained in this experiment, it does not seem advisable to use S. C. White Leghorns for broiler production.

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TABLE 1

Average biweekly weights of the different lots

AGE	LOT I	LOT II	LOT III
	grams	*grams*	*grams*
1 day	28.7∓ 0.79	39.0∓ 0.89	36.9∓ 0.82
2 weeks	49.2∓ 3.31	75.6∓ 4.15	70.1∓ 3.57
4 weeks	89.2∓ 8.09	127.5∓ 8.19	107.7∓ 6.41
6 weeks	149.1∓21.75	197.1∓17.66	173.4∓16.39
8 weeks	224.9∓24.33	287.2∓30.80	256.7∓35.15
10 weeks	348.9∓43.25	438.2∓46.68	405.5∓38.33
12 weeks	508.8∓48.34	604.0∓51.05	571.4∓40.88
Relative efficiency, per cent	100.00	118.70	112.29

TABLE 2

Returns above feed cost based on 100 chicks at start

ITEMS	LOT I	LOT II	LOT III
Total amount of feed consumed, kilograms	183.33	214.35	150.21
Total cost of feed, pesos	38.58	45.11	31.61
Broilers produced, kilograms	24.25	27.15	19.48
Returns from sale of broilers, pesos	60.68	67.87	48.69
Feed required per kilogram gain, kilograms	5.23	5.15	5.66
Cost of feed to produce a kilogram gain, pesos	1.10	1.08	1.19
Returns above cost of feed, pesos	22.10	22.76	17.08

CANTON AND PACOL, TWO PROMISING SOURCES OF PULP FOR THE MANUFACTURE OF KRAFT PAPER AND NEWSPRINT IN THE PHILIPPINES[1]

Pedro A. David
Of the Department of Agronomy

Canton and pacol are two other members of the genus *Musa*, which abound in the Bicol region and other parts of the Philippines. Under ordinary field conditions, they grow and multiply rapidly with very little care and cultivation. Other important attributes of these two musaceous plants are: ability to adapt themselves to soils and climate where abacá (*Musa textilis* Née) varieties do not thrive well; power to kill or outgrow pernicious weeds like aguiñgay, (*Rottboellia exaltata* Linn. f.) cogon (*Imperata cylindrica* (Linn.) Beauv. var. *Koenigii* (Retz) Benth and talahib (*Saccharum spontaneum* Linn.); and freedom from serious diseases, such as bunchy-top and mosaic, and injurious insect pests which commonly attack abacá and banana.

Canton and pacol are of little value as sources of fiber for cordage manufacture because their fibers are very much inferior to the abacá fiber in tensile strength. Their possibilities as sources of cellulose or pulp materials, either for export purposes or for local manufacture of kraft and newsprint, have been suggested. Careful observations on the cultural requirements and important characteristics of canton and pacol, and a study of the amount of dry pulp and fiber obtainable from a given weight of harvestable stalks grown in the College of Agriculture Experiment Station, were made in the Department of Agronomy with the assistance of Mr. José R. Mondoñedo in answer to requests made by industrialists, particularly by Dr. F. T. Adriano, Assistant Vice-President, San Miguel Brewery, Manila.

THE CANTON

The canton in Albay resembles abacá in its external features and habit of growth (Quisumbing and Elayda [1926]). It is very similar to, if not identical botanically with, *Musa cantoni*, a seeded banana. It can be distinguished from the abacá by the presence of pinkish coloration at the lower surface of its leaves, particularly of the young one. As to its origin, whether or not canton is a hybrid between abacá and wild banana, is yet to be determined.

When clean, the individual fiber of canton is distinctly tapering from the base to the tip. The fiber is lighter in weight and weaker in tensile strength than abacá of the same grade. Canton fiber is cleaned with serrated knives in an ordinary "hagutan". The fiber, dingy light brown and dingy light yellow, is turned out in the form of narrow but distinct strips not exceeding one millimeter in width. Three distinct grades of canton fibers

[1]Experiment Station Contribution No. 1562.

similar in cleaning and color to the standard grades of abacá are obtainable. Thus Canton-One grade is similar in cleaning and color to abacá grades of J2 and above; Canton-Two to K, L1, L2, and DL; and Canton-Three to M1, M2, and DM, depending on the number of teeth or serrations on the stripping knife. The difference between abacá and canton fibers of the same grade of cleaning is very slight and it can hardly be noticed by the inexperienced buyer, especially when the basal tips of the canton fiber are cut off on account of the discoloration caused by careless or improper handling and drying. Because canton fiber is similar in cleaning and color to abacá grades of J2, K, M1 (fair); L1, L2, M2 (coarse), and DL, DM (very coarse cleaning), it is sometimes used for adulterating abacá fiber of these different grades.

THE PACOL

Quisumbing and Elayda (1926), in their report on abacá varieties in the Bicol region, state that pacol is undoubtedly a *Musa errans*, a wild banana resembling the Butuan variety in habit and other characters.

Like that of canton, the fiber of pacol is used to a limited extent for adulterating abacá fibers. The fiber of pacol is easily distinguished from those of abacá and canton. It is much weaker and softer than either of the two fibers. Pacol rarely produces a commercial grade higher than grade J2 (Superior Seconds No. 2) of abacá, because the fiber is too weak to withstand the pressure of the knife used in the stripping of well-cleaned and high-grade abacá fibers. Two grades of pacol fiber are similar in cleaning and color to abacá grades. These are Pacol-One, which is similar to abacá grades J2, K, M1 (of fair cleaning); and Pacol-Two, similar to L1, L2, M2 (of coarse cleaning), and DL, DM (of very coarse cleaning).

THE CULTURE OF CANTON AND PACOL IN THE COLLEGE OF AGRICULTURE

Propagation. Canton and pacol are easily propagated by suckers or divisions of the corms. Although the fruits are full of seeds, fertile seeds are rarely produced.

Soil and climate. Canton and pacol are drought resistant. They grow well on loose, moist, and well-drained soils of the College, with practically no care and cultivation. They are able to stand conditions in which abacá does not do well.

Spacing. Canton and pacol are planted 3×3 meters apart in ordinary soils, and 2.75×3.75 meters apart in rich loam. With this distancing, they grow luxuriantly and give a good yield.

Habit of growth. Canton and pacol grow faster and more vigorously than abacá grown side by side with them. Twenty months after planting, canton and pacol may have 15 to 25 suckers of different ages in a stool. The plants spread and increase more rapidly than abacá. They outgrow and kill weeds like aguiñgay, cogon, and talahib. When the mother plants die and the suckers spread, the center of the hills are left open and clean. Canton and pacol require practically no care and cultivation.

Diseases and pests. Unlike the abacá, canton and pacol are not attacked by abacá mosaic and bunchy-top diseases. Under the College of Agriculture conditions, canton and pacol are practically free from injurious insect pests.

Harvesting. For fiber production, canton and pacol are ready for harvesting 18 to 20 months after planting. The fiber reaches its maximum tensile strength shortly before the plants flower.

Extraction of fiber and pulp. The fiber of canton and pacol is extracted like the abacá fiber, with the use of "hagutan". Canton and pacol are easy to strip. Fiber extraction is facilitated by allowing the cut stalks to remain on the ground to wilt for two or three days before stripping. For pulp production, the overlapping leaf-sheaths are first separated from the stalk, crushed by passing through a small sugar mill roller to squeeze much of the water, and dried in the sun. It takes about 24 hours to dry the crushed leaf-sheaths during the hot months.

Yield. There is no significant difference between canton and pacol in the amount of dry fiber with pulp and in clean fiber. Based on the weight of the freshly cut stalk (table 1), canton yields from 3.95 to 4.65 per cent of dry fiber with pulp and pacol, 3.72 to 4.52 per cent. Canton and pacol produce from 0.9 to 1.5 per cent clean dry fibers.

Classification of Canton and Pacol fibers. The name, official designation, cleaning and color of the different commercial standard grades of canton and pacol as described in the *Fiber Inspection Administrative Order No. 4* (Revised) are given below:

GRADE	OFFICIAL DESIGNATION	CLEANING AND COLOR OF FIBER COMPARED WITH ABACA GRADES
Canton-One	Can-1	Fibers are similar to J2 and above
Canton-Two	Can-2	Similar to K, L1, L2, and DL.
Canton-Three	Can-3	Similar to M1, M2, and DM
Canton-X	Can-X	Consists of damaged fibers, strings, tow, and waste which does not fit in any of the normal grades of canton.
Pacol-One	Pcl-1	Similar to J2, K, and M1 abacá grades.
Pacol-Two	Pcl-2	Similar to L1, L2, M2, DL, and DM
Pacol-X	Pcl-X	Consists of damaged fibers, strings, tow, and waste which does not fit in any of the other grades of pacol

Only serrated knives are used for extracting canton and pacol fibers. For fair cleaning (grades J2, K, and M1), a knife of 17 teeth to the inch is used; for coarse cleaning (grades L1, L2, and M2), a knife of not less than 14 teeth to the inch; and for very coarse cleaning (grades DL and DM), a knife of less than 14 teeth to the inch.

Although canton and pacol may be used as an additional source of minor hard fiber for the cordage industry, production for this purpose should not be encouraged because it would affect adversely our Manila hemp industry. The use of their fiber for adulterating abacá fiber is even worse than marketing them as minor hard fiber. Adulteration weakens the abacá fiber and destroys the reputation of the Manila hemp as the best fiber in the world for cordage purposes.

At this time when the United States is financing the expansion of abacá culture in Central and South American countries in order to have a near-by available supply of this strategic material in time of emergency, greater care than before should be exercised in the production of Manila hemp for export. The quality of our prewar Manila hemp has not yet been

equalled by the American-produced abacá fiber. The American abacá, however, easily equals the quality of our postwar Manila hemp, owing to the fact that this is an admixture of fibers from mature and immature stalks of abacá (Berkley, Hessler, Burneston, and Chew, 1949).

As canton and pacol are promising sources of pulp for the paper industry or for the manufacture of kraft and newsprint in the Philippines, their production for this purpose deserves serious consideration and encouragement. Canton and pacol are adapted to grassy areas of land which are not suitable for abacá growing. They thrive well under wild conditions, outgrow grasses and destroy them, need no care, grow fast and multiply rapidly, free from destructive pests and diseases, and give a good yield of pulp.

SUMMARY

1. A small planting of canton and pacol which were introduced from Albay in 1939, was made in the College of Agriculture. The plants required practically no care and cultivation. They produced harvestable stalks 20 months after planting.

2. Canton produces about 2 per cent cleaned fiber and 5 per cent dry pulp and fiber 20 months after planting. Under conditions in the College of Agriculture Experiment Station, pacol produces about the same yield.

3. Canton and pacol fibers are lighter in weight and weaker in tensile strength than abacá fiber. They should not be marketed as hard fiber for cordage purposes. Neither should they be used for adulterating abacá because they affect the quality of the Manila hemp fiber and mar its reputation abroad. The commercial grades of canton and pacol are similar in cleaning and color to fair, coarse, and very coarse grades of abacá.

4. The immunity of canton and pacol to destructive abacá diseases and insect pests, as well as their adaptability to adverse conditions, makes them important for planting in areas not suited to abacá. They are easy to grow, adapted to places where abacá does not thrive well, multiply rapidly, destroy pernicious grass weeds, and produce good yield.

5. Canton and pacol are promising sources of cellulose or pulp for export or for the manufacture in the Philippines of cheap paper and carton.

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TABLE 1

Measurements and weights of five stalks of canton and five stalks of pacol harvested 20 months after planting. The individual leaf-sheaths were crushed in a small sugar-cane mill roller, and dried in the sun to a constant weight

MEASUREMENTS AND WEIGHTS	CANTON STALKS					PACOL STALKS				
	1	2	3	4	5	1	2	3	4	5
Length, in meters	4.3	3.5	3.5	3.9	4.2	3.6	3.0	3.3	3.8	3.6
Diameter of base, in centimeters	23	17	18	20	23	22	23	21	22	20
Diameter of top, in centimeters	13	11	11	13	14	12	13	12	12	10
Weight of fresh stalks, in kilograms	65.2	31.1	32.4	53.0	58.0	46.4	58.4	48.2	46.4	35.4
Weight of dry fiber with pulp, in kilograms	2.65	1.23	1.28	2.22	2.70	2.10	2.27	2.01	1.89	1.32
Percentage of dry fiber with pulp	4.26	3.95	3.95	4.19	4.65	4.52	3.88	4.17	4.07	3.72

A PROGRESS REPORT ON DECORTICATION AND DEGUMMING OF RAMIE, *BOEHMERIA NIVEA* (LINN.) GAUDICH[1]

PEDRO A. DAVID
Of the Department of Agronomy

With the present interest on ramie and the versatility of its product for the manufacture of important goods of various descriptions, a study of decortication and degumming ramie fibers from the different varieties was carried out in the College of Agriculture from July, 1948, to July, 1950. Technical difficulties encountered in these two processes have served as the limiting factor in successful exploitation of ramie in the Philippines.

Two methods of decortication and degumming were tried. First, the newly harvested or cut stalks without previous treatment were decorticated with a small machine run by a 1-1/2 to 2-1/2 h.p. engine. The resulting fibers were firmly embedded in a gummy substance to which clung bark and "sticks," or broken stems. The incrusted materials were partially removed by the usual after-treatments—washing, brushing, and drying in the sun. The second method consisted of previously retting the bare stems by immersing them in a tank of slow running water for 50 and 100 hours. After this treatment, the stems were decorticated while still wet, the fibers washed and thoroughly dried in the sun. With the second method, even a gummy variety, like Guiran Taipan No. 1, yielded an improved product after 50 hours of slow retting. The cleaned fiber may be described as "good". There were no clinging bark and "sticks" (broken stems). The fibers were whiter and very much softer in texture than those cleaned with the first method. The prepared fiber was similar in cleaning and color to the standard grade, RD-A, Ramie Special. The fiber bore less gummy substance than those produced by the first method.

For degumming the decorticated ramie fibers of the different varieties grown in the College of Agriculture, two methods were tried as follows:

Soap solution. The decorticated ramie fibers were boiled for about 30 minutes in a solution of 15 grams of ordinary laundry soap (which evidently contains an excess of lye) in 1000 cc. of water. The fibers were then carefully washed by hand in tap water with laundry soap. The water was wrung out and the fibers were thoroughly dried in the sun. The whole degumming process required little more than half an hour. Thorough sun-drying is important because it brings out the natural white sheen of the fibers. The amount of degummed fibers, sometimes called "filasse," which was very white, lustrous, and almost cottonized, was more than 58 per cent of the raw and dry fibers treated.

Fermentation process. The fermentation process of degumming was carried out by burying the raw fibers about 15 centimeters deep in the ground near a washing tank. Other trials were made by immersing the decorticated ramie basts in water containing suspensions of a "pusali"

[1]Experiment Station Contribution No. 1563.

(muddy pool under the kitchen floor). Rice wash water, or "hugas", thin rice gruel, and washings from white molds that had developed on old coffee berries and on seedboxes in the nursery were also tried.

The samples of the raw fibers for degumming were immersed in the different solutions and suspensions for a number of days, depending on weather conditions. It was believed that the product of the microorganism living in the solutions and soil suspensions acted on the gums and pectic substances and dissolved them, so they could be washed off. Of the fibers degummed with the various solutions tried in the College, those in fermenting solutions of either rice washings or of thin rice gruel produced lustrous and easily cottonized fibers. More than 52 per cent, by weight, of the raw fibers turned out as fine, white, and lustrous fiber. Isolation and further studies of the most promising of the microorganisms responsible for degumming are being carried out with the co-operation of Dr. José B. Uichanco, of the College of Veterinary Medicine, University of the Philippines. A determination of the tensile strength of the individual cleaned fibers obtained from the different methods of degumming is also in progress.

SUMMARY

1. Fresh ramie stems, without previous treatment, when decorticated, produced light brown fibers which were heavily incrusted in gum and clinging pieces of bark or sticks.

2. After 50 hours of slow retting, the resulting decorticated fiber was of better quality than that from fresh untreated stems.

3. Satisfactory results in degumming were obtained with the aid of a weak solution of common laundry soap in water, doubtless owing to the free lye present.

4. Various ferments from different sources were tried with equally-gratifying results. Work on the isolation of the most promising of the organisms and on the comparative determination of the tensile strength of the fibers produced is in progress.

COLLEGE AND ALUMNI NOTES

The opening exercises for the school year 1950-51 were held on Wednesday morning, June 28, 1950, at the Agricultural Chemistry Lecture Hall.

Mr. S. H. Dunn, of Warner, Barnes and Co., Manila, and Mr. N. Sykes, of the Imperial Chemical Industries (China) Ltd., Hong Kong, conferred with Dean Uichanco, Dr. G. O. Ocfemia, and Dr. G. B. Viado on May 30, 1950, on new insecticides, fungicides, and weed killers manufactured by the ICI and represented in the Philippines by Warner, Barnes and Co.

Two students, Pedro B. Escuro and José O. Juliano, qualified for University scholarships this semester. Reynaldo G. Marquez and Ibarra S. Santos were granted College scholarships.

Mr. Alfonso Eusebio, '44, returned on June 16, 1950, after two years of advanced studies in dairy bacteriology at the Iowa State College at Ames, Iowa, where he was awarded the degree of Master of Science.

Mr. Quirino T. Tagorda, '48, resigned as assistant instructor in the U.P. Rural High School, effective June 24, 1950, to accept a teaching position at the Fatima High School in Santiago, Isabela.

Three alumni who graduated in October, 1949, were appointed assistant instructors in the College, effective June 1, 1950. They are Messrs. Bernardino Q. Ballesteros, Department of Agricultural Botany; Teofilo S. Eugenio, Department of Agronomy; and Clemente P. Juliano, Jr., Department of Agricultural Engineering.

In a meeting on July 1, 1950, the College faculty approved to recommend the graduation, as of 1942, of Mr. Rodolfo L. Guerrero. Mr. Guerrero finished all the requirements for graduation at the outbreak of the last war, but it was only recently that records pertaining to his case were cleared up.

The total enrollment in the College at the close of the registration period on June 26, 1950, was 536, or 164 more than that of last year. There are 26 girls in the present student body. The freshman students number 275, or 110 more than those of last year.

Mr. Karl Knaus, of the USDA agricultural extension service, was a campus visitor on June 23, 1950, accompanied by Messrs. Hepler and Abbey, Dr. Amando M. Dalisay, '37, and Attorney Cornelio V. Crucillo, '25. Mr. Knaus was on his way to Pakistan, where he is assigned as a technician under President Truman's Point IV Program.

Dr. W. J. Ellis, chief field scientific officer for the Far East, UNESCO, and Mrs. K. Dillabough, of the American Embassy, were campus visitors on June 25, 1950. They were making a study of the extent of farm mechanization in the Philippines.

Miss Clare R. Baltazar, '47 *summa cum laude*, a Fulbright scholar at the University of Wisconsin, obtained her M. S. degree in entomology. She returned on the S. S. *General Gordon*, which reached Manila on July 27, 1950.

Four prospective graduates were added to the list of the College alumni when the faculty, in a meeting in July, 1950, approved to recommend the graduation of the following: Esperidion P. Agustin, Pedro L. Esteban, Oscar R. Mabanag, and Raymundo M. Tawatao.

Mr. Joseph C. Ryan, Consultant on Co-operation of the FAO, visited the College on July 25, 1950, and conferred with Doctors Valente Villegas and Francisco M. Fronda on Philippine cattle raising and the Los Baños Cantonese and Nagoya breeds of chickens. He was accompanied by Messrs. Anastasio de Castro, of the National Co-operative Administration, and Ernesto Parial, Co-operative Supervisor of Laguna. Mr. Ryan is considering the advisability of sending students from India to the College.

The 193rd scientific meeting of the Los Baños Biological Club was held on July 28, 1950. The following papers were read and discussed: "Observations on the effects of a Synthetic Estrogen on S. C. White Leghorn roosters," by Mr. Amado C. Campos, and "Shrinkage of concentrates during storage," by Dr. Valente Villegas.

In the 194th meeting held on August 25, 1950, Dr. Leon G. Gonzalez read a paper, prepared by Dr. Leon G. Gonzalez and Mr. Florante Cruz Salvador, on the inter-generic graft affinity of the lanzones, *Lansium domesticum* Correa.

In the 195th meeting held on September 29, the following paper was read and discussed: "Consumers' preferences in the City of Manila for eggs and poultry," by Mr. Quintin de la Torre, Mr. N. B. Tablante, and Dr. F. M. Fronda.

In a letter received by Dean Uichanco, Rev. John J. Dahlheimer, S.J., of the China mission, expressed his sincere thanks to the Dean, Dr. F. M. Sacay, and Mr. N. B. Tablante for speedily furnishing him with precise information on Philippine economics. The information, according to the Jesuit Father, had cleared up for him a lot of problems regarding the economic future of the Islands.

Mr. Lourdio L. Clamohoy, through the recommendation of the College, is the recipient of a Students' Assistance scholarship from the Manila Rotary Club. The scholarship, which covers expenses for tuition fees, textbooks, board and lodging for the school year 1950-51, was offered by the club to help the most deserving needy student of the College.

The College library recently received a donation of fifty pesos from the U. P. Junior Student Council. In acknowledging the donation, Dean Uichanco expressed to the council president, Mr. Teodoro Padilla, the gratitude and appreciation of the entire College community.

Four of the Fulbright scholars who left for the United States on the S.S. *General Gordon* on July 28, 1950, are College alumni. They are as follows: Mr. Victorino C. Andrion, '48, of the Department of Agriculture and Natural Resources, who will pursue advanced studies in soil conservation and agricultural engineering at the Michigan State College of Agriculture; Mr. Pedro N. Laudencia, '49, a Stanvac pensionado, who will take up postgraduate work at the Louisiana State University; Mr. José R. Mondoñedo, '49, assistant instructor at the College, who will pursue advanced courses in agronomy at the University of Maryland; and Mr. Narciso Pepito, '34, who will specialize in livestock farming at the same University.

Two members of the Bell economic survey mission visited the College on August 8, 1950. They are Dr. August L. Strand, president of the Oregon State College, and Mr. C. M. Purves, of the Office of Foreign Agricultural Relations of the USDA. They were accompanied by Mr. John V. Hepler. The three guests, after being introduced by Dean Uichanco, spoke at a special convocation. Luncheon was served at the home economics laboratory of the Rural High School.

The College Faculty-Employee Organization donated fifty-three pesos to the Maquiling School. The amount was utilized in buying a kerosene stove with oven for the home economics class of the school. The donation was part of the proceeds of the faculty-employee benefit program which was held last March.

Mr. Apolinario R. Carañgal, Jr., '48, *cum laude*, assistant instructor in agricultural chemistry, left for the United States on August 11, 1950, as a Fulbright scholar. He will pursue advanced studies in chemistry at the Ohio State University in Columbus.

Mr. Filomeno T. Tabayoyong, '47, resigned as assistant instructor in the Department of Soils, effective August 1, 1950, to accept the position of soil chemist at the Victorias Sugar Milling Co., Inc., in Negros Occidental.

Dr. Otto A. Reinking, agricultural adviser to the Philippine Government, on August 16, 1950, conferred with Dr. G. O. Ocfemia on the mosaic disease of abacá and its control in the provinces of Davao and Cotabato.

The amount of ₱393.63 was turned over to the College of Agriculture Students' Emergency Loan Fund by Dr. F. O. Santos in his capacity as executive secretary and associate treasurer of the Copeland Travel Fund Committee. This amount represents the balance after deducting all expenses in connection with the coming of Dr. E. B. Copeland last April, from the sum contributed by alumni, totalling ₱5,688.56.

In a meeting of the Maquiling School patrons last August 11, the following were elected members of the Board of Trustees: Doctors L. B. Uichanco, F. M. Sacay, F. M. Fronda, Prof. M. A. Gapud, and Mr. Leon R. Ela. The restoration of the seventh grade in the Maquiling School was deliberated upon, but no decision on the matter was reached. After the meeting, refreshments were served to the patrons at the Maquiling School Building.

Dean L. B. Uichanco, '15, was the guest speaker at the luncheon meeting of the San Pablo Rotary Club on September 5, 1950.

Dr. Faustino T. Orillo, '44, returned on the S. S. *President Cleveland* on August 27, 1950, after a stay of four years in the United States as a fellow of the University of the Philippines. He was awarded the Ph.D. degree in mycology at Harvard University. He has returned to the staff of the Department of Plant Pathology.

Mr. Amado C. Campos, '49, assistant instructor in animal husbandry, has been awarded a 12-month study and training grant in poultry genetics by the U. S. government. He left for Washington, D. C., on August 28.

Alumni and others interested in acquiring copies of *Philippine Agriculture*, Volume I, Field Crops, are advised to secure their copies before

the stock is exhausted. As a limited number of cloth-bound copies are available, those desiring them should place their reservations with the Dean's Office immediately.

This volume is a 1949 enlarged revision of the section on field crops of the 1939 Handbook. It consists of 863 pages, and measures $5\frac{3}{4}'' \times 7\frac{1}{2}''$.

A donor, who prefers to remain anonymous, gave ₱1,000 to the College for the purchase of incubators to be rented to students. The income from the rent is to be used for maintenance of the incubators and for the purchase of additional poultry equipment.

Dr. Donald de Leon, entomologist of the USDA., and Dr. Otto A. Reinking were campus visitors on September 5, 1950. They were accompanied by Dr. Gonzalo F. Merino, '14, of the Bureau of Plant Industry.

Mr. H. Luthi, of Singapore, accompanied by Mr. R. Rebold, of Manila, came to the College on August 22 to discuss with Doctor Ocfemia the bunchy-top and mosaic diseases of abacá.

Forty-four books on agriculture, which were sent to Dr. F. M. Sacay by Dr. W. T. Spanton, chief of the Agricultural Education Section of the U. S. Office of Education, were turned over to the College library. The books were donated by members of the staff of the section in response of Dr. Spanton's invitation, which was made at the instance of Dr. R. M. Stewart, former professor of Dr. Sacay at Cornell University and recently detailed to the Office of Education.

Mr. Valentin G. Cedillo, '42, joined the faculty of the U.P. Rural High School on September 7, 1950. A welcome program in his honor was held by the Rural High School student body on the same date. Mr. Cedillo was formerly teaching at the Aroroy High School in Masbate. He is a holder of the Certificate in Agricultural Education.

Mr. Gil F. Saguiguit, '47, a U.P. fellow, returned on September 17, 1950, on the S. S. *President Wilson*, after a year's postgraduate study at the University of Illinois, where he was awarded a Master's degree in agricultural education. He was honored with a welcome program and dance by the U.P. Rural High School student body on September 19, 1950.

THE EXPERIMENT STATION

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No. 8.—Horse Breeding in the Philippines..... *By V. Villegas*

No. 10.—Practical Directions for Coffee Planting (Revised by Charles Fuller Baker, Dean, College of Agriculture, 1917-1927.)..... *By Pedro A. David*

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The price of the circulars listed above is thirty centavos (₱0.30) each.

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(Required by Act No. 2580)

The undersigned, business manager of THE PHILIPPINE AGRICULTURIST, published quarterly in English at the College of Agriculture, College, Laguna, after having been duly sworn in accordance with law, hereby submits the following statement of ownership, management, circulation, etc., which is required by Act 2580, as amended by Commonwealth Act 201:

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J. M. CAPINPIN
Business Manager

Subscribed and sworn to before me this 9th day of April, 1951, at Los Baños, Laguna, the affiant exhibiting his Residence Certificate No. A4383559, issued at Los Baños, Laguna, on January 2, 1951.

AURELIO C. ALMASAN
Municipal Mayor
Los Baños, Laguna